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THE AUTOMOBILE

Skillful Work Is Silencing American Motors and Chassis

Attention to Detail Is Eliminating Lost Motion, Gives Reduced Wear and Promotes Quietness— Rattling Accessories Are Among Noisy Nuisances

Working to Close Limits the Surest Cure in Many Cases—Cam Design of Utmost Importance—Use of Spiral Gears, Silent Chains, Etc., Increasing

SILENCE of action marks the ultimate refinement of a machine. Noiseless action once secured, it only remains necessary to use proper materials to perpetuate this condition. The steps made by American designers toward securing a quiet running motor have been particularly marked during the past few years and this advance has gone hand in hand with advances in metallurgy—the art of selecting the proper metal for the proper place. To the casual observer the noises issuing from the different parts of the car combine into one inharmonious whole, but to the trained ear the chorus is dissected and each component hiss, groan and squeak is assigned its proper place.

In the motor there are four prominent sources of noise: the valve action, timing gears, magneto drive and carbureter. These parts can be segregated and treated separately. The noise of one has no bearing upon the noise of the other.

In answer to the question, "What have you done to silence your valve action?" THE AUTOMOBILE received a series of answers from the most prominent engineers throughout the country showing that, although the means differed, the earnest attention of the engineering staffs was turned toward a study of this particular part of the motor.

The valve action of the poppet-valve motor can be separated into the cam, follower mechanism, tappet and valve.

The root of the noise evil in the valve action has been traced to the cam. This presents a problem which engineers have not yet reduced to such a point that they are unanimous upon the point as to which is the best cam for all around use. There are two causes of cam noise, first, the striking of the side of the cam against the follower, and, second, the striking of the follower against the cam due to the fact that on the down stroke of the valve at high speed the cam runs away from the follower for a brief interval and then the latter strikes it with sufficient impact to create a sharp tap. With a cam so designed that the follower never leaves it, it is evident that this noise disappears. At the same time, however, this means a slower

Fifteen Silence-Producing Points That Are Becoming General Practice

Designing cams that give power with silence.
Using helical gears in the timing set.
Replacing gears by silent chain and sprockets.
Inserting felt and fiber pads at contact points.
Reducing clearance at valve tappet to .003 inch.
Fitting cover plates over parts that are noisy.
Using leather, springs and rigid keys in magneto drive.
Limiting backlash in gearset from .001 to .003 inch.
Employing aluminum and other non-resonant metals.
Making gears solid to eliminate bell action.
Putting accessible adjustments on rear axle.
Using worm drive in place of bevel gears.
Fitting spiral springs to compensate for wear.
Firmly attaching lamps, horns and other accessories.

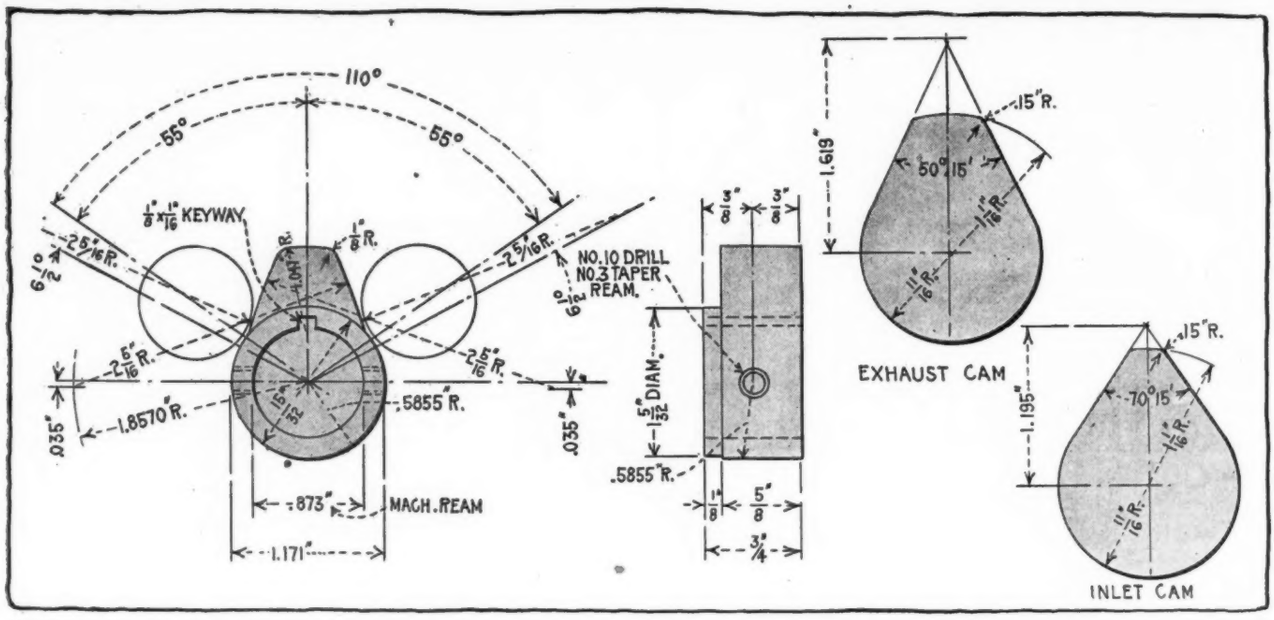

Fig. 1—Left, full working drawing of a straight-sided cam. Right, illustrating difference in intake and exhaust cams

movement of the valve and consequently an appreciable falling off on power. The maximum power is secured with the flat-sided cam giving quick opening, closing and—noise. One maker states, "Our touring cars are much more silent than our speedsters and racing cars because we are able to make a cam of more advantageous shape, the opening and closing of the valves not being as sudden." Another, who uses the cam design shown at the right of Fig. 4, states, "You will notice that there are no flat spots on the profile and hence, by keeping close to the limits, we are able to secure quietness in operation."

A study of Figs. 1 and 4 gives an idea as to general practice. Neglecting the variations in the shape of the cam due to the difference in valve timing of the different motors, the factors which determine the contour are the type of linkage used, the function of the valve, whether inlet or exhaust, the lift and diameter of the valve and their relationship, piston displacement per unit of time of the motor, and, it may be added, the purpose of the motor, although perhaps this latter is taken in with the others.

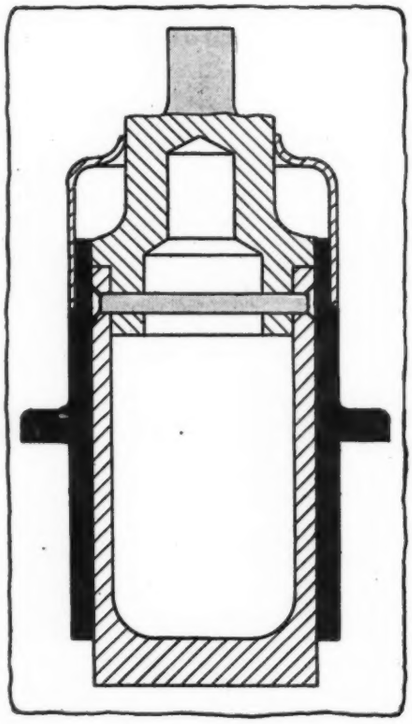

Fig. 2—Valve lifter; note light construction

Although all other parts of the valve mechanism may be interchangeable, the exhaust and inlet cams must be different. This may readily be perceived if the action of the exhaust gases is taken into consideration. There must be a sufficiently large opening of the valve when it is first released to allow the pressure to drop to atmospheric before the piston starts on its up, or true, exhaust stroke. If not there is a considerable loss of power. This means a sudden and quick opening of the exhaust valve and hence a steep cam. Note the contours of the exhaust cams in Fig. 1. These are examples of a quick opening. In comparison with this the enlarged exhaust cam in Fig. 4 may be studied. The tangent lines are drawn from the point at which the valve starts to open and are hence a measure of the slope of the cam at this point. The further away the intersection of these two is from the center of the cam, the earlier the opening.

It is evident that a flat-sided cam, such as that shown in Fig. 1, will give a quicker opening than the rounded cam shown in Fig. 4. It is also evident that the noise which accompanies the overcoming of the inertia of the valves and linkage will be greater with this flat-sided cam because the clearance is taken up more suddenly. The two cams in Fig. 4 have been enlarged to show the relation between the cam contour and the clearance which is laid out in the dotted circle surrounding the cams. When the cam comes into action, the distance between the surface of the cam and the clearance circle will be zero. For the sake of simplicity, let the clearance as outlined in the clearance circle, Fig. 4, represent all the clearance in the mechanism. That is, between the cam and follower, as well as in the component linkage. Supposing for the moment that the side of the cam is absolutely flat, as is the case in racing cars, where noise is no objection and power the object. The impact of the cam on the follower is resisted by the weight W of the whole valve action as well as by the pressure P of the gases within the cylinder upon the valve head and the tension of the valve springs. The factors W and P are referred to later.

This shows the tremendous hammering effect produced by the flat or straight-sided cam. Taking the force of the blow as even 10 pounds, however, it can be readily perceived that the noise of a metal-to-metal contact at any speed would be considerable. This neglects such features as bad adjustments between stem and tappet, etc. It is a question of power versus silence.

Before leaving the subject of cams, one more cause of cam noise should be considered. It is just as important to have a quick closing as opening. The valve cannot be closed any more quickly than the spring can act. If the cam runs away from

the follower when the valve begins to close, the follower will impinge upon the cam immediately afterwards giving a hammer blow which is a noise producer. This is a question of cam and spring design. The springs must be heavy enough to keep the follower on the cam, the cams must be of such design that they do not necessitate too heavy a spring to keep the followers upon them and finally the springs cannot be so heavy that they consume too much power and necessitate too much energy in lifting them. The latter fact is of particular importance in that it is a distinct factor in the noise and hammer effect in the opening of the valve.

Engineers and designers are trying to get the power-giving cam and silence at the same time by using non-vibrating and cushioning materials. Fiber lends itself to this purpose with more success than most other materials, although the use of felt washers between contact points has had considerable success and is a growing practice.

So far no mention has been made of friction in the valve mechanism itself. Friction is important because it is an indirect cause of increased noise. It increases the factor W in the impact formula. Friction depends upon three things: First, area of contact; second, quantity and quality of lubrication; third, pressure between bearing surfaces. Taking these up separately the area of surface contact may be first mentioned. Friction is included in the factor W and directly affects the inertia.

Actual contact will only exist between the lifter and guides and the valve stem and guides. Other contact than this can be neglected. Taking the valve lifter, for instance, a general type of which will be seen in Fig. 2, the first consideration is that there must be sufficient bearing surface to take care of the side thrust due to the side component of the thrust delivered by the cam to the lifter when the cam acts directly upon it. When the thrust is delivered through a follower and other linkage the side thrust is practically eliminated, although other factors enter. Oil leakage is also to be guarded against and a long guide aids in this. The illustration represents general practice. The length of the valve stem guide must be sufficient to prevent leakage and must be arranged so as to be adequately cooled to prevent sticking.

Lubrication of the followers will present no difficulty. Indeed, the trouble will be the other way, as there is a marked tendency for the oil to leak through the guides and down the side of the crankcase. Fig. 2 shows the light metal cap generally used to guard against this.

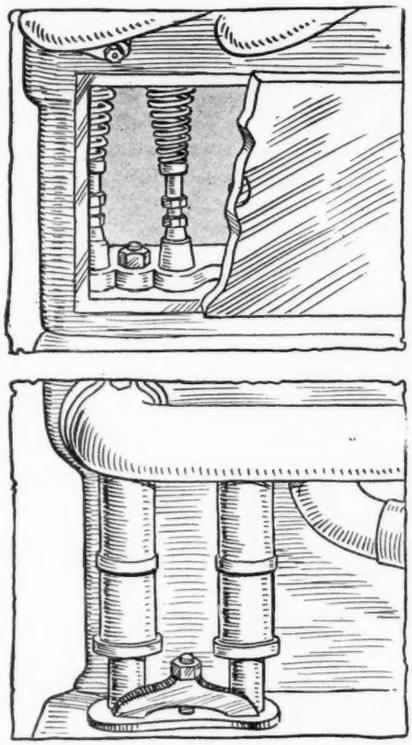

Fig. 3—Upper, cover plate for two valves. Lower, independent cover tubes

Pressure between bearing surfaces is due in the case of the following mechanism and in the tappet guides by side thrust and by the weight of the parts. All parts of the valve mechanism should be as light as possible. The principal reason for this, however, is to cut down the factor W in the equation for inertia mentioned above.

Admitting that a certain amount of noise throughout the valve action in the poppet type is a necessity, it is interesting to note what means are taken to render the sound inaudible to a person sitting in the car. Fig. 3 shows two methods of inclosing the valves. The upper illustrations show a method that is growing in favor. It is, in fact, an individual housing over each spring and tappet. The lower illustration shows the more popular form of housing. This is a complete housing for the entire side of the motor, or, where the cylinders are cast in pairs, the housing extends over each pair of cylinders. Aluminum or other non-resonant material is used here.

What used to be a prolific source of noise are the timing gears. Spur gears which do not mesh as well as they should produce a grinding hum that stands out

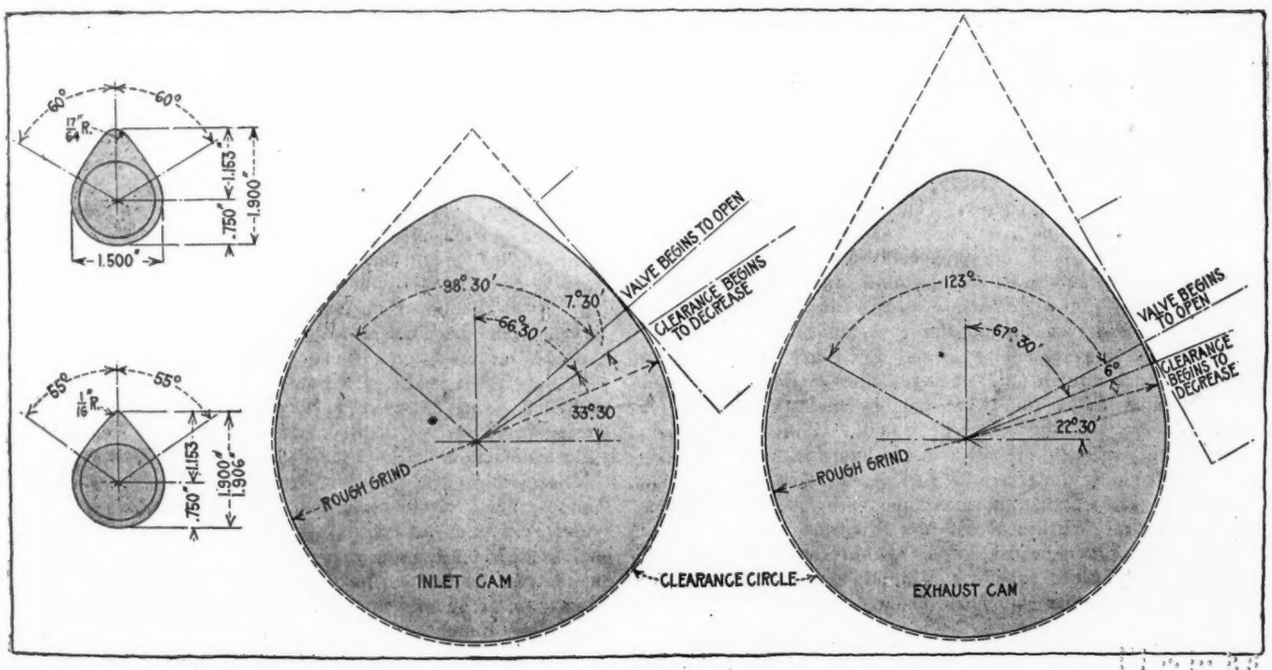

Fig. 4—Left, curved exhaust and inlet cams. Right, enlarged view of cams, showing clearance circles

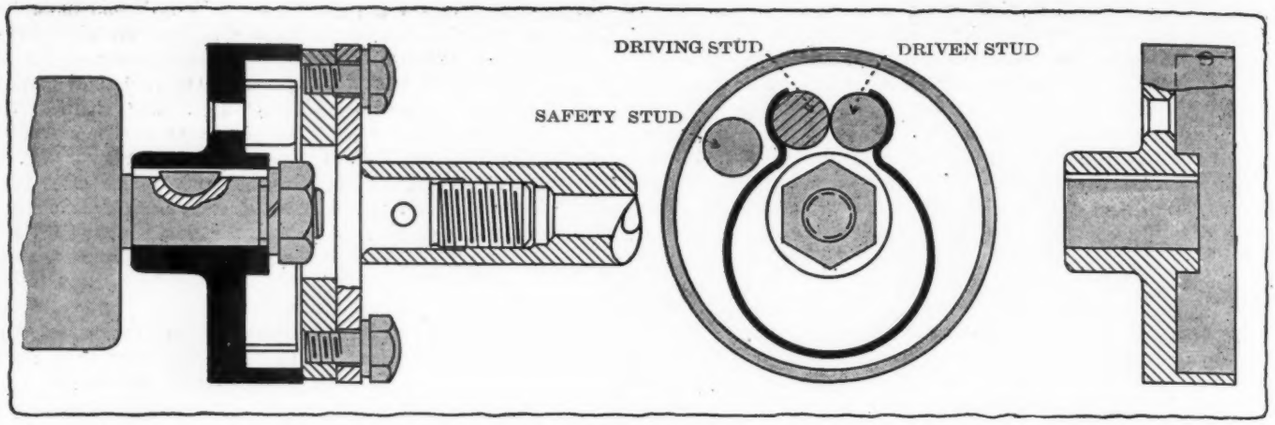

Fig. 5—Side and transverse sections of spring magneto drive and a side section through feather type

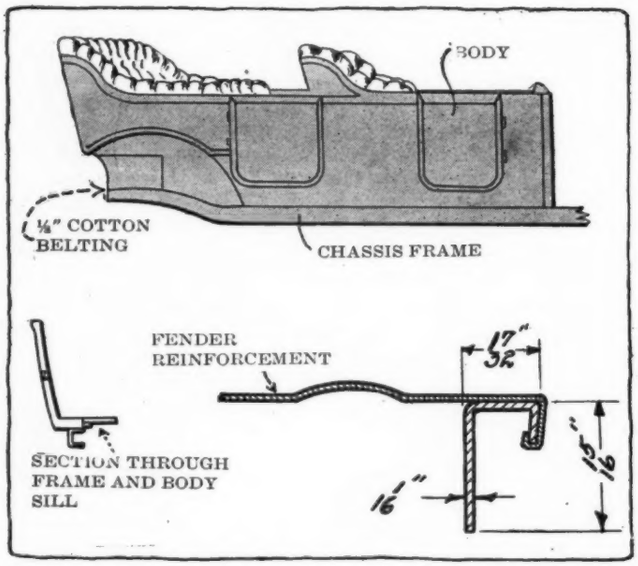

Fig. 6—Means taken to eliminate body and fender squeaks

above the other noises as black against white. Three methods are now used to overcome noise in this part of the mechanism: Improved methods of manufacture of spur gears, the use of spiral gears and silent chains. It may be stated here in reference to the improved methods of gear manufacturing that owing to the competition of the silent chain and the spiral gear and other devices the manufacturers have been compelled to focus their attention on this matter. The result is that they are all grinding to closer limits or have changed over to the helical gears or chain drive. The statements of some of the leading engineers on this subject in response to a canvass by THE AUTOMOBILE are as follows: "We are using helical gears which are almost noiseless even though they are not meshed properly." "All timing gears are cut twice and any that vary more than .00025 inch are thrown out." Several other engineers gave this as the limit to which they were grinding their timing gears of the spur type. Another engineer stated that the timing gears used by his concern were made silent by "using a steep angle spiral and holding the eccentricity of gears below .001 inch and fitting the gears so that the maximum back lash is .003 inch." Another states, "We use a cast iron against a steel gear, both of which are cut in helical shape." Other engineers state that they limit back lash to .001 inch; maintain center distances to .001 inch; and many other statements tending to show that the care in manufacture has increased. In one case the engineer of a large factory claimed that he was obliged to adopt a gear of not greater than 15 degrees angle of spiral with 10 pitch on account of an electric starter which operated through them. In his opinion, however, the 29-degree spiral was much more silent.

The engineer of a concern using a chain-driven timing set states that they were obliged to adopt a chain larger than that recommended by chain manufacturers for the reason that the smaller sizes would not stand up under a heavy load. To further produce silence with these chains they are using a composite fiber sprocket for the magneto gear to reduce the hum.

The above shows that in many cases it is a question of improved manufacture rather than changed design. The old type of motor with its ill-fitting pistons, rings and bearings was noisy and would not stand up because there was too much lost motion. The tendency towards cutting down the limits of tolerance was greater during the past year than ever. The cry for close grinding work from the engineer was responded to by the workman and tool maker to a remarkable degree. Ringing gears are becoming unknown. The solid gear eliminates the bell action of the lighter designs and cures another source of noise.

Many magneto couplings are noisy. The old style of Oldham coupling was particularly troublesome in this respect, starting to rattle as soon as a small amount of play developed. The magneto drive of today is through a coupling which compensates for the lost motion as soon as it occurs, in other words, the drive is through a spring. For the sake of illustration a detailed drawing of one form of magneto coupling is shown in Fig. 5. As may be seen from the lettered view, the drive is through studs. The spring, shown in black, holds the driving stud against the driven stud in spite of any wear that could occur between these two studs. The safety stud is to take care of the coupling in case of any breakage of the spring. The side section is shown to the left of Fig. 5. As may be seen, the drive is taken up by the magneto through a No. 3 Woodruff key furnished on the magneto shaft. A simple form of keyed magneto connection is shown in part section at the right end of Fig. 5. A prominent magneto concern uses a laminated flat spring. The drive is directly through this spring, which is located transversely on the end of the drive shaft, and engages with the driven shaft by means of a slot through which the laminated spring passes. The flexibility is thus gained through the laminated spring. Leather couplings are also used and give great satisfaction. They have met with great favor in Europe.

Noises which emanate from the gearset are prevented in the same manner as those which exist in the timing gears, with the evident exception of spiral gears. The use of non-resonant materials for the housing is a particularly valuable feature here, but the true way of curing noisy gears is by working to closer limits. Accuracy of gear cutting is one of the first requisites of a quiet-running motor. The rear axle is the same. Where the limit formerly was .002 inch it has been reduced to .00025 inch in many of the best factories. It is a significant fact that

bevel-gear rear axles became noticeably more quiet as soon as the worm drive began to make itself felt as an important contender on account of its silence. It has been the same story over again of the valves. When the sleeve-valve motor began to cut such a wide swath in the industry immediately the poppet-valve makers fought back with the same weapon—silence.

Noise in the gearset is generally found on the first and reverse speeds. This is natural owing to the larger number of teeth in engagement and hence for the greatly increased chance of back lash. Noise in the rear axle is not so apt to be apparent when the car is new as after it has been run for about a month. It is then that the noise which was at first concealed perhaps by a heavy packing of grease begins to make itself felt. In order to get away from this makers are preparing tests on the rear axles which bring out every weak point. One maker says, "Our rear axles are coupled to a dynamometer and driven by means of an electric motor for a considerable time before being placed in the car. They must pass inspection for silence before being accepted." The testing room is the greatest factor in securing silence there is. Its power of accepting and rejecting should be and is absolute in a large factory.

Spring leaves and bolts should receive more than the modicum of attention that is sometimes the case. The fitting and lubrication of the bolts has received special attention in one factory where they have fitted a wick within the bolt. The oil is fed to the bearing surface by capillary attraction and it is claimed that one filling will last for 1,000 miles. Integral grease cups, etc., are old institutions, but are still being fitted to carefully designed cars. In connection with remarks on spring bolts it may be said in passing that there are makers who believe that spring bolts, built as specified by S. A. E. standards, are too tight to permit of good lubrication and hence give rise to squeaks.

Chattering brakes are not as common as they were at one time. The customary attaching of drag springs to keep the shoes free of the drums under running conditions is satisfactory. It may be stated that the linkage is noisy at times, however, and this is prevented in many cases by the introduction of spiral springs which take up the rattle.

Probably more rattle issues from the miscellaneous gear about the car than from the motor and running gear put together. The sketches in Fig. 7 show some of the ingenious methods in use to suppress these rattles. At the top right is shown at A and B the two coil springs fitted in the floating member of the universal joint. This construction does not entail much expense and certainly makes for silent running. The same car is fitted with a rubber block in connection with the torsion lever bumper link; this is shown just below the universal joint floating member. Rattling drag links are common after a car has been run more than 10,000 miles. One maker gets away from this by putting in a spiral spring, as shown at the left end of Fig. 7. Adjoining this sketch is another showing the use of a spiral spring which will eliminate the rattle of the bottom pan very effectually.

A particularly frequent source of noise is to be found in the fitting of windshields. These are often fitted by two or three brass clips which hold them to the dash. The clips are sure to work loose after a time and the result is that the windshield is free to move over the dash, creating a squeak which is distinctly audible. The attachment shown in Fig. 7 with a rubber pad between the dash and the shield silences one source of squeak effectually, while the other source, between the dash and the shield, is prevented by lapping the filler board over the dash. Lamps can make a very disagreeable rattle, but not when fitted into the top of the dash cowl, as shown in the lower right corner of Fig. 7.

All the squeaks issuing from the poor mounting of accessories such as horns, speedometers, lamps, license plates, trunk racks, tire brackets, etc., cannot be compared to the squeak which will issue from a badly mounted body. The use of a layer of anti-squeak material between the frame members and the body is universal. This is placed as indicated in Fig. 6. It generally consists of woven cotton belting or sometimes rubber or felt. A tight connection between the body and frame is naturally imperative for other reasons than silence. Reinforcements throughout, however, are good noise preventers and not the least of these is the fender reinforcement as shown in Fig. 6. Where it is not a case of silence versus power, as it is in many parts of the car as pointed out, good workmanship is the answer.

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THE AUTOMOBILE wishes to extend its thanks to the many prominent engineers who have kindly furnished information showing the present practice in their respective plants and the means employed in approaching the problem of silence both in its entirety and in detail.

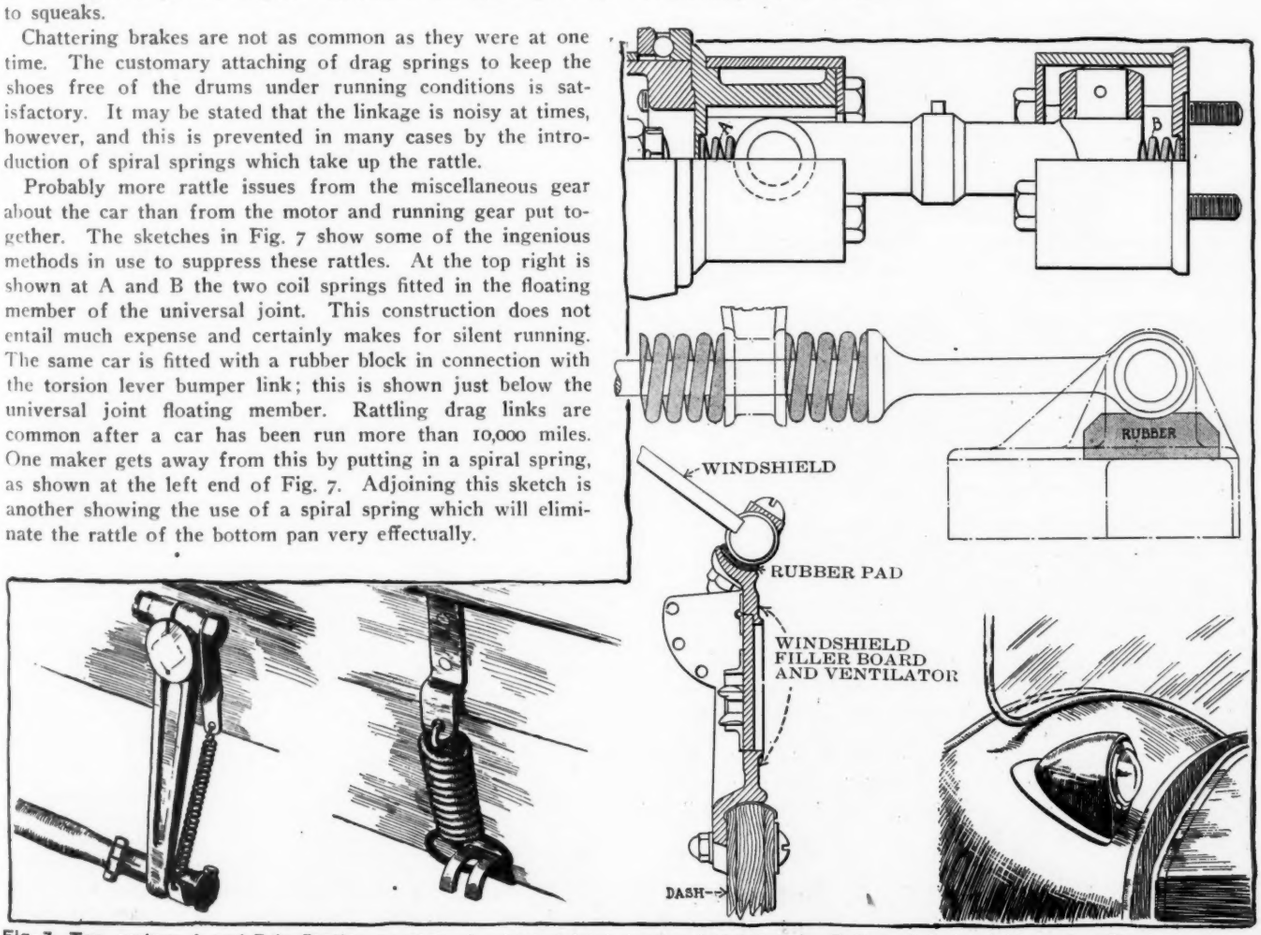

Fig. 7—Top, springs A and B in floating member of universal joint, torsion bumper rod. Bottom, left to right, spring fitted to drag link, spring bottom pan holder, padded windshield connection, non-rattling lamp

Flanders Named As Head

Receivers of U. S. Motor Co. Announce New Manager of All the Properties Emerging From Bankruptcy

Another Spark Plug Suit—W. C. P. Settlement Approved —Grabowsky Company Bankrupt—Other Trade News

ANNOUNCEMENT made Tuesday by Robert Walker and W. E. S. Strong, receivers for the United States Motor Company, makes public the appointment of Walter E. Flanders as manager of the company and its five factory subsidiaries for the receivers and W. F. McGuire as assistant manager. They will have authority over all departments of the company except the auditing, accounting and treasury, which will be operated for the present by the incumbent forces.

For various reasons there has been considerable delay in getting started on the manufacturing schedule of the Maxwell plants but the receivers have just announced that the preliminary work has been concluded and that the flotation of the $1,500,000 of receivers' certificates will be undertaken shortly. It was found that another inspection of the plants had to be made and this served to delay proceedings.

Practically 96 per cent. of the claims against the company have been filed with the designated depositary and the time for depositing stocks has been extended until December 15, when it is expected that about 60 per cent. will have been impounded.

The course of the procedure has not all been smooth, however. Suit has been entered against the company in the New Jersey branch of the United States District Court on behalf of three creditors whose claims aggregate about $5,000. The grounds for the action apparently are that the New York suit is invalid because the complainant company, the Brown & Sharpe Manufacturing Company is a Rhode Island Corporation and the United States Motor Company has its legal existence in New Jersey. The apparent theory of the complainants in this case is based upon the same assumption as was the demurrer to the court's jurisdiction which was informally filed in the New York suit. Judge Hough disposed of the claim by stating from the bench that in his opinion, he did have jurisdiction. Whether or not there is any element of contempt of court in the New Jersey suit is a question that has stirred up considerable interest in New York.

Spark Plug Repairs To Be Tested

Suit has been entered in the United States District Court by the Rajah Auto Supply Company against the American Auto Supply Company charging infringement of the Mills patent 825,856, covering porcelain spark-plugs. While the patent itself forms the basis of the suit, the main contention is that the defendant company made a practice of advertising and selling the porcelain parts of spark-plugs with which to repair Rajah plugs.

The suit raises an interesting point of law somewhat similar but much more limited in its scope than the point involved in the famous Dick Mimeograph case. The Rajah people claim that under their patent they have the right to insist on repairing their own plugs, using a patented material. In the Dick case the Supreme Court held that the patentee had the right to control the use of unpatented material with the patented device. Newell and Neal represent the Rajah party.

Court Approves W. C. P. Settlement

Following favorable action by the creditors of Wyckoff, Church and Partridge, Inc., the United States District Court has issued an order approving the sale of the assets of the embarrassed corporation to Chester Griswold, Howard C. Dickinson and George W. Ellis. The assets will be turned over to the committee on Saturday. The creditors receive $150,000 in cash in addition to certain credits that have been marshaled by the receiver, John S. Sheppard, Jr., which amount to between $20,000 and $30,000. All told the settlement means something over 27 cents on the dollar.

The claim against the Driggs-Seabury Ordnance Corporation and the counterclaim of that company together with the property of Wyckoff, Church and Partridge, Inc., held by the Driggs-Seabury company are not considered in the settlement. The attornews who have handled the matter state that the elements of the controversy will approximately balance.

A corporation to continue the business is in process of formation and its details will be announced subsequent to the actual consummation of the court action.

John S. Sheppard, Jr., has been named as trustee for the creditors.

Grabowsky Company Bankrupt

DETROIT, MICH., Nov. 25—The Grabowsky Power Wagon Company was adjudicated a bankrupt by Judge Tuttle, in the United States District Court on November 22. The concern will be operated by the receiver, the Federal Trust Company, until December 5, when a meeting of the creditors will take place, at which bids for the plant and equipment will be considered.

Receiver Named for Poss Company

DETROIT, MICH., Nov. 25—Affairs of the Poss Motor Company were brought to a head last week with the filing of a petition in the United States District Court before Judge Tuttle by the

Automobile Securities Quotations

THE stock market was strong again last week with Goodyear's continued advance the feature. This stock shot up $38 a share on a few bids and fewer sales, making another new mark at 450. Firestone also showed great strength, being marked up 5 points over last week's level. Goodrich declined a point on the New York Stock Exchange and the other tire companies were steady.

	1911 Bid	1911 Asked	1912 Bid	1912 Asked
Ajab-Grieb Rubber Co., com	..	..	180	191
Ajax-Grieb Rubber Co., pfd	..	..	100	104
Aluminum Castings Co., pfd	..	..	100	102
American Locomotive Co., com	36	36½	46	46½
American Locomotive Co., pfd	106½	107	103	103½
Chalmers Motor Company	..	..	125	145
Consolidated Rubber Tire Co., com	7	11	11	14
Consolidated Rubber Tire Co., pfd	10	20	50	60
Firestone Tire & Rubber Co., com	175	180	290	295
Firestone Tire & Rubber Co., pfd	107	109	105½	107
Garford Company, preferred	..	..	99	100
General Motors Company, com	37½	38½	37	38
General Motors Company, pfd	77	79	79	79½
B. F. Goodrich Company, com	*240	*245	70	70½
B. F. Goodrich Company, pfd	*118½	*119½	106¾	107¼
Goodyear Tire & Rubber Co., com	230	240	450	455
Goodyear Tire & Rubber Co., pfd	104	106½	104½	105½
Hayes Manufacturing Company	..	..	..	90
International Motor Co., com	..	..	20½	22½
International Motor Co., pfd	..	..	74	78
Lozier Motor Company	..	..	..	45
Miller Rubber Company	..	..	143	147
Packard Motor Company, pfd	104½	106	105½	107½
Peerless Motor Company	..	..	115	120
Pope Manufacturing Co., com	40	45	27	29
Pope Manufacturing Co., pfd	66	70	70	72
Reo Motor Truck Company	8	10	8¾	9½
Reo Motor Car Company	23	25	19½	21½
Studebaker Company, common	..	..	42	43½
Studebaker Company, preferred	..	..	94	96
Swinehart Tire Company	..	..	99	101
Rubber Goods Mfg. Company, com	85	95	100	..
Rubber Goods Mfg. Company, pfd	100	105	105	108
U. S. Motor Company, com	*17	*19	8	10
U. S. Motor Company, pfd	*62	*64	‡30	‡35
U. S. Motor Company, 1st preferred	..	..	65	70
White Company, preferred	..	..	105	108

*Old. ‡Second preferred.

Detroit Foundry Company and several other creditors, to have the Poss concern adjudicated a bankrupt. E. H. Rogers was appointed receiver, and the case referred to Lee E. Joslyn.

It is claimed by the petitioners that the Poss company is insolvent and that the plant has not been in operation for the past 3 or 4 months. It is further claimed that a number of judgments have been filed against the concern.

The Poss Motor Company will contest the granting of the petition when it comes up in court again within 2 weeks, on the ground that with the help of the major creditors' committee which is now engaged with its affairs, it can be set on its feet. Reorganization plans are at present under way. It is stated that $150,000 new capital is needed and that half of this amount was in sight when the petition was filed by the minority creditors.

It is further contended that the truck is a good one and can be sold as fast as manufactured, and that additional capital is what is needed to make the concern a paying proposition.

Durant Heads Chevrolet Company

DETROIT, MICH., Nov. 25—The following officers were elected at a recent meeting here of the board of directors of the Chevrolet Motor Company, Flint, Mich.: W. C. Durant, president; J. D. Port, vice-president; W. H. Little, second vice-president; Dr. E. R. Campbell, treasurer; C. R. Hathaway, secretary; W. M. Murphy, assistant secretary.

Daimler Import Assets Very Small

Schedules in bankruptcy of the Daimler Import Company show liabilities of $67,261 and assets of $4,626.. The latter consist of an automobile, spare parts, accounts and a bond for $2,000. The liabilities consist of claims by Lawrence F. Braine and the New Netherlands Bank, H. A. Content and others.

Market Changes of the Week

FEW changes took place in the markets last week. Antimony, Bessemer steel, copper electric, lead and scrap rubber had changes. Antimony dropped $.00 1-8 on Thursday, closing at $.08 7-8. Bessemer steel dropped $.50 on Monday, due to poor trading, closing at $27.50 per ton. Copper electric suffered a material change of $.00 1-10. Lead dropped $.10 on Thursday, closing on Monday at $4.50 per 100 pounds. Tire scrap declined on Thursday $.00 1-8 and remained at that figure throughout the rest of the week, closing at $.09 7-8. Copper lake, open-hearth steel, petroleum, and tin remained constant. In the chemical market sulphuric acid and cyanide potash remained at their old figures of $.99 and $.19 respectively. Gasoline, linseed oil, rapeseed oil and lard oil offered no material changes in prices, closing at $.21, $.52, $.73, and $.96 respectively.

Material	Wed.	Thurs.	Frl.	Sat.	Mon.	Week's Change
Antimony, per lb.	.09	.08⅞	.08⅞	.08⅞	.07⅞	—.00⅛
Beams and Channels, 100 lbs.	1.61	1.61	1.61	1.61	1.61	.....
Bessemer Steel, ton.	28.00	28.00	28.00	28.00	27.50	—.50
Copper E'ec., lb.	.17½	.17 9/20	.17⅜	.17⅜	.17⅜	—.00 1/10
Copper Lake, lb.	.17⅝	.17⅝	.17⅝	.17⅝	.17⅝	.....
Cottonseed Oil, Nov., bbl.	6.03	6.17	6.17	6.17	6.17	+.14
Cyanide Potash, lb.	.19	.19	.19	.19	.19	.....
Fish Oil (Menhaden)	.33	.33	.33	.33	.33	.....
Gasoline, Auto, 200 gals. @	.21	.21	.21	.21	.21	.....
Lard Oil, prime.	.96	.96	.96	.96	.96	.....
Lead, 100 lbs.	4.60	4.50	4.50	4.50	4.50	—.10
Linseed Oil.	.52	.52	.52	.52	.52	.....
Open-Hearth Steel, ton.	28.00	28.00	28.00	28.00	28.00	.....
Petroleum, bbl., Kansas, crude	.73	.73	.73	.73	.73	.....
Petroleum, bbl., Pa., crude	1.80	1.85	1.85	1.85	1.85	.....
Rapeseed Oil, refined	.73	.73	.73	.73	.73	.....
Silk, raw Ital.	....	4.40	....	....	4.37½	—.02½
Silk, raw Japan	....	3.90	....	....	3.90	.....
Sulphuric Acid, 60 Beaumé	.99	.99	.99	.99	.99	.....
Tin, 100 lbs.	4.95	4.95	4.95	4.95	4.95	.....
Tire Scrap	.09¼	.09⅛	.09⅛	.09⅛	.09⅛	—.00⅛

Huber Case in Spotlight

Patent Trial Interests Detroit Industry—Packard Adds Three More Buildings To Its Factory Plant

Five Manufacturing Companies Announce Changes and Promotions Affecting Their Department Heads

DETROIT, MICH., Nov. 25—Preparations for taking testimony in the Emil Huber three-point suspension patent case brought by the North American Vehicle Company, owner of the patent, against the Detroit Taxicab and Transfer Company, which is being defended by the Kelly Motor Truck Company, maker of the trucks operated by the Taxicab concern, are now under way. R. A. Parker, attorney for the plaintiff, states that in all probability the case will be begun in about 2 weeks, or as soon as the models which he is having prepared are completed. It will come before Judge Tuttle in the United States District Court in this city.

Changes in Michigan Factories

DETROIT, MICH., Nov. 25—The past week has seen a number of changes among the department heads of various Michigan factories. Among the more prominent are the following:

E. A. Nelson, chief engineer of the Hupp Motor Car Company, has resigned that position to take up consulting work. His position will be taken by his former assistant, F. E. Watts, while D. T. Hastings, formerly with the Packard company, will assume the duties of assistant engineer.

The Cass Motor Truck Company, Port Huron, Mich., has engaged E. J. Farkas, formerly chief engineer of the Cartercar Company, Pontiac, Mich., as consulting engineer. He is at present engaged in developing a line of trucks for the concern.

J. J. Ramsey has become vice-president and treasurer of the A. C. Knapp company, body makers. Mr. Knapp's former connection was with the E. R. Thomas Company, Buffalo, of which he was secretary and treasurer.

The Olds Motor Works, Lansing, Mich., now has E. R. Van Linden as its factory manager. G. D. Baker, who formerly held that position, having resigned to become manager of the Diesel Engine plant, Ghent, Belgium. Mr. Van Linden held a similar position with the Buick plant No. 1, at Flint, Mich.

The Flanders Motor Company has added W. F. McGuire to its staff as production manager. Owing to ill health Mr. McGuire resigned last spring from a similar position with the Ford Motor Company.

Packard Adds Three New Buildings

DETROIT, MICH., Nov. 25—The Packard Motor Car Company has enlarged its factory plant to the extent of three new buildings which are now in the course of construction. They are to be entirely of steel, concrete and glass and are in line with the company's policy of shop units. The Packard company already has 37 acres of floor space, and these new buildings, which bring the number up to thirty-three, will swell the acreage to about forty. About 7,000 men are at present employed at the plant, the weekly pay-roll amounting to about $500,000.

DETROIT, MICH., Nov. 23—The Gearless Differential Company has been incorporated with a capital stock of $20,000 to manufacture a patented differential device which is claimed to do away with gears for this part of the rear axle. A system of ratchets and rollers is employed. The incorporators are: Frank Howarth, G. D. Bailey and W. N. Trudean.

Warren Board Is Enlarged

Directors' Committee to Consist of Nine Members—First Solid Tire in West Built at St. Louis

Ohio Answers Insolvency Suit—Foreign Trade Will Pass $4,000,000,000-Mark Before the Year Ends

DETROIT, MICH., Nov. 25—At a meeting of the directors of the Warren Motor Car Company, several changes were made in the personnel of the concern. Homer Warren was re-elected president; C. R. Wilson was made vice-president; F. T. Lewis, secretary, and L. M. Hamlin, treasurer. R. W. Allen, formerly secretary of the organization was made general manager and assistant secretary and treasurer.

Under the reorganization, the directors' committee consists of nine as follows: Homer Warren, C. L. Wilson, C. H. Wilson, H. H. Bassett, S. G. Jencks, F. T. Lewis, John Mowe, G. Jahn and L. M. Hamlin. This committee is at present working on a trust agreement which will be submitted to those interested about the first of December.

First Solid Tire Built in West

ST. LOUIS, Nov. 25—The St. Louis Tire and Rubber Company, which was organized recently in this city turned out the first solid tire Saturday. This is the first solid rubber automobile tire to be made west of the Mississippi River.

J. A. Swinehart, who is vice-president and general manager of the new firm, stated that the company obtained possession of the building November 6, broke ground for the engine on the same day, unloaded all the machinery from the cars, placed same in running order and turned out a tire in 17 days.

Mr. Swinehart stated that there is no foundation for the report that the St. Louis concern is a branch of the Swinehart Company, of Akron.

Ohio Answers Insolvency Suit

CINCINNATI, O., Nov. 25—The Ohio Motor Car Company, against which the Eisemann Magneto Company and other creditors brought proceedings in involuntary bankruptcy a few weeks ago, has filed its answer denying that it is insolvent or that it has committed any act of bankruptcy as charged. A demand is made for a hearing before a jury. President C. F. Pratt, upon the authority of the board of directors, made the answer. Great efforts are being made to reinforce the Cathage plant. It is thought that the bankruptcy matter will be cleaned up the same as it was 2 years ago. According to a rumor, West Virginia capitalists have offered $600,000 for the plant.

Foreign Trade Over $4,000,000,000

Preliminary estimates of the foreign business of the United States for the calendar year of 1912 indicate that the aggregate will be not far from $4,000,000,000. This will be divided into exports, $2,300,000,000, and imports, $1,800,000,000. The big exports of grain may raise the total of out-bound shipment above the figures given. Imports have doubled in value since 1901 and exports since 1904.

Mais Factions Fight for Dividend

INDIANAPOLIS, IND., Nov. 25—Stockholders and creditors of the old Mais Motor Car Company are making a lively fight in the Superior Court in Indianapolis to determine which shall receive about $80,000 which is in the hands of Franklin Vonnegut, received for the concern. The property and business of the company was sold some time ago to a reorganized company by the same name, headed by Frank H. Wheeler.

When the company was in debt about $180,000 and before the receivership proceedings had been brought, creditors agreed to an extension of time if they should receive a payment of $75,000. The company raised $67,000 in cash and a note for $8,000 and paid the money to the creditors.

The stockholders now claim that the creditors were to receive nothing unless they received the full amount of $75,000, and that the payment of $67,000 was therefore illegal. They also claim they have a trust interest in the money in the receiver's hands.

Palmer Factory Nearing Completion

DETROIT, MICH., Nov. 23—The Suburban Motor Car Company, which has in construction an automobile factory at Ecorse, a suburb of Detroit, has been reorganized under the name of the Palmer Motor Car Company, of which R. A. Palmer, former general manager of the Cartercar Company, Pontiac, Mich., is vice-president and general manager. Mr. Palmer is also president of the Palmer-Bee Company, dealers in power transmission machinery and factory equipment.

The Ecorse plant is about half completed and it is hoped that it can be finished so that manufacturing may be commenced the first of the year, at which time announcement of the type of cars it contemplates building will be made.

W. A. DeSchaum, who designed the Suburban car, will not be connected with the concern.

Underwood Metal Bill as Revision Basis

The Underwood bill revising the tariff on metals, which was passed by both houses of Congress early this year and which encountered the veto of President Taft, will probably form the basis of the new legislation to be adopted at the special session of Congress next spring.

The metal schedule incorporated in the Underwood measure provided for a tax of 6 per cent. on pig iron; 10 per cent. on alloys and from 15 to 35 per cent. ad valorem on various kinds of manufactured and partially manufactured metals. These rates represent a downward revision of from 2 to 25 per cent.

The free list under the Underwood bill includes iron ore, hoop and band iron, barbed wire, fence wire, cut and wrought nails, tungsten ores, and a few other items.

Bankers Offer Overland Stock Purchase

Advance offering of the recently purchased block of $5,000,000 first preferred stock of the Willys-Overland Company has been made by William Salomon & Company. The stock bears 7 per cent. cumulative dividends. On the basis of last year's report of consolidated earnings, the company earned 66 per cent. on the preferred issue. According to the Salomon announcement, the company sold 22,548 cars in 1911-1912 season and for the year ending June 30, 1913, expects to put out 38,200. Figuring on that basis the bankers state that the company should earn full par value on the preferred issue offered.

DETROIT, MICH., Nov. 25—The first real get-together meeting of the Detroit Section of the Society of Automobile Engineers was staged at the Detroit Motor Boat Club house on Thursday evening, November 21. An informal dinner was served and there were 125 on hand to enjoy the repast. This is the largest gathering which has ever turned out for an affair of any nature given by the Detroit section. No engineering subjects were discussed, the object being to afford the members an opportunity to become better acquainted with one another. By offering social advantages to its members in addition to those merely technical it is hoped to gather in many others.

Grand Prix To Be Revived

French Club Decides to Run Classic Next Year With Small Field if Necessary But Extends Time

New York Dealers Organize To Rehabilitate Contests and Seek to Secure the 1913 Vanderbilt Cup Race

PARIS, Nov. 15—After being buried, the French Grand Prix race has been revived, the Automobile Club of France deciding to hold the race whatever the number of starters and to admit entries at ordinary fees until December 31, and at double fees until March 31. The race will be held during the first fortnight in July; the place has not yet been selected. At the present time there are seventeen entries, the makes being Sunbeam, Delage, Peugeot, Schneider, Itala (with valveless model) Mathis, Mercedes, and Opel.

In an interview, Chevalier Rene de Knyff, president of the sporting committee of the Automobile Club of France, gave it as his opinion that with the extended time for receiving entries the total number would be thirty-five or probably forty starters, thus assuring a most interesting race.

It was recognized that the original decision to close the lists at the end of October was a mistake, for a number of concerns were unable to decide whether they would be able to compete at such an early date, and even those who had entered were unable to commence the construction of cars until they had received assurance that the race would really be held.

A sidelight on the reasons which led the Automobile Club to revive its Grand Prix, after having obtained only sixteen out of the necessary forty entries, is given by *L'Echo des Sports*. "The real reason why the Automobile Club of France has decided to preserve its Grand Prix is the attitude of the newspaper *L'Auto*. Once more our contemporary has earned the hearty thanks of the automobile industry. Without it the Grand Prix would certainly have been dead and buried. It must not be supposed that this is a joke; it may be a little ironical, but that is all. We can declare to-day, without fear of contradiction, that *L'Auto* was not expecting the results it has provoked. All that it hoped for was the burial of the Grand Prix, although it took care not to give public expression to that hope. It would have followed the funeral procession with tears and lamentations; it would have accompanied the defunct as far as the cemetery. Then, having taken off its black coat, it would have rolled up its sleeves and given itself up heart and soul to the triumph of its own race, that race which was announced in all the majesty of big headlines and leaded matter in the issue of the paper declaring the certain abandonment of the Grand Prix, dead with only sixteen out of the necessary forty entries. It was a note of defiance which awoke the club to action. Without this note the automobile club would have been content to allow its Grand Prix to sleep its eternal sleep. Instead, it rushed into the fray, taking a decision which has earned for it the compliments of all lovers of sport."

The 3-litre race, to be held by *L'Auto*, has been fixed for Sunday, June 29, the course not yet being decided on. Present entries are Peugeot and Delage, but the list does not close until March, and it is confidently expected that between thirty and forty cars will be secured.

New York Dealers Seek Vanderbilt

The Motor Dealers' Contest Association, of New York, composed of prominent members of the metropolitan trade, was formed Monday at a meeting attended by about forty. The purpose of the organization is to rehabilitate racing, road contests and tours and the main object that confronts it is the capture of the 1913 Vanderbilt Cup race. The tentative plans of the association are to secure the race and run it on Long Island.

The association will be incorporated for $30,000 and the shares will be sold among the trade, the individual concerns of which are limited to three shares each. The machinery of the organization will consist of a board of directors, numbering eleven; an executive committee consisting of eight and three committees; respectively on racing, road contests and touring to be named by the board.

Temporary Chairman John C. Wetmore has announced the following committee to canvass the trade for co-operative support: George H. Robertson, William C. Poertner, Edward McShane, E. Lescaris, J. C. Nicholls, A. J. Inderrieden and E. F. Korbel.

Contest Board Rules on Protests

At the last meeting of the Contest Board A. A. A. the appeal of the Central Auto Company, of Grand Rapids, Mich., from the referee's decision in the recent reliability run of the Grand Rapids Automobile Club, penalizing a Cadillac car two points for raising the hood in control, was overruled. The hood was raised by an outsider but the board ruled that the possibility of such an occurrence showed negligence on the part of appellant.

The Coey-Mitchel Auto Company and the Stutz Motor Car Company, of Chicago, were suspended until June 1, 1913, for failure to report for start in the recent run around Lake Michigan.

The Moline Automobile Company and the Staver Carriage Company were suspended until June 1 for advertising the performances of the Moline and Staver-Chicago cars in the Lake Michigan run as those of stock cars.

Hoosiers Endorse Coast Tour

INDIANAPOLIS, IND., Nov. 25—The Indiana Automobile Manufacturers' Association, at a meeting in the Claypool Hotel in this city last Thursday night, gave a plan for a run from Indianapolis to the Pacific Coast its unqualified indorsement. This means that the Indiana manufacturers will make the trip, and July 4 was selected tentatively as the date for making the start from Indianapolis.

This trip will take the place of the Indiana Four States Tour which was held this year and last. It is estimated that a car with two occupants can make the trip for $370, including the return trip by rail. The route has not been selected and a committee is now working out this feature of the run.

H. O. Smith, of the Premier Motor Manufacturing Company, has suggested that immediately following the arrival at the Pacific Coast, exhibits of Indiana-made cars be held in Los Angeles, San Francisco, Portland and Seattle.

Motor Truck Club Extends Scope

The Motor Truck Club, of New York, has elected Ellis S. Howland secretary and general manager and has secured official headquarters at 1845 Broadway. The club intends to maintain a bureau for the collection and distribution of data on automobile trucks. It will hold weekly sessions at which leading men in the industry will be invited to speak.

The welfare committee, consisting of L. A. Van Patten, Emerson Brooks, E. W. Curtis, Jr., and Arthur J. Slade, has outlined some of the new activities in its recent report. Among the recommendations are the following: That a bureau of information be established to secure specific information about costs; that a registry of motor truck drivers be established; that the committee on papers work out programs for the coming year so that special emphasis can be laid successively upon the various phases of truck operation and numerous other practical suggestions.

Market for Motor Trucks Outlined By Industries

OF much interest to the industry is the following article and compilation issued by the commercial vehicle committee of the National Association of Automobile Manufacturers on the market for trucks as shown by the interest displayed by the various commercial industries in the last national shows.

A tabulation of all responses received to invitations to attend last winter's shows has been made by the statistical department of the National Association of Automobile Manufacturers. Invitations were sent, in round numbers, to 40,000 companies located in the territory embraced by the New England, Middle Atlantic and North Central states as far south as Tennessee and as far west as Oklahoma. Most of these companies have a financial rating of $50,000 or more, indicating that they are easily capable of buying trucks or delivery wagons.

About 7,500 companies responded to the invitations, and these are included in the tabulation, making the most comprehensive investigation ever undertaken along this line.

As originally compiled, the list showed 225 distinct lines of business, including manufacturers, jobbers, wholesalers, retailers, commission merchants and others in each line. These various trades have been rearranged into broad groups of allied lines for convenient reference. In order of the number of replies received, the trades most prominently represented are as follows:

Building and contracting trades	482
Metal and hardware trades	392
Grocery trades	306
Machinery and tool trades:	276
Light, heat and power companies	255
Dry goods and clothing trades	253
Furniture, beds and bedding, carpets, rugs and house furnishing	223
Brewing and liquor trade	219
Expressing, teaming, etc	214
Coal and wood	205
Printing, publishing and allied trades	176
City governments	155
Lumber trades	151
Textiles and dyeing	143
Paints, oil and decorating trades	142
Heating, plumbing and steam fitting trades	126
Department stores	123
Storage and moving	117
Produce and commission	117
Steam railroads and equipment	112
Paper and paper box trades	111
Meat and packing trades	106
Boots, shoes, hats, gloves and men's furnishing	100

It should be borne in mind that the number of companies represented in any particular trade is not necessarily an indication of the exact relative interest of that trade in commercial motor vehicles nor of its probable absorbing ability during the coming year. These are dependent upon the proportion borne by the number represented in the list to the total number of companies in each trade in the territory tributary to the shows and the average number of trucks operated by the truck owning companies in that trade. For example, the probable demand for power vehicles by the 123 department stores would greatly exceed the demand by the 176 printing and publishing companies or the 117 storage and moving companies.

In the entire United States there are 4,700 department stores, of which 123, or about 1 in 38, are represented in the show list; there are 989 storage warehouses in the country, of which 78, or 1 in 12, responded to show invitations; and there are 26,500 printers and publishers, of whom 133, or 1 in 200, responded

The tabulation is appended, with the trades insignificantly represented omitted.

Trades Represented at National Motor Truck Shows

	Chicago Show	N. Y. Show	Both
Baking and bakers' supplies	19	31	50
Barrels and boxes	15	15	30
Brewing and malting	72	72	144
Wines and liquors	18	48	66
Bar supplies	5	4	9
	95	124	219
Building and contracting	81	188	269
Building materials	28	45	73
Brick, tile, stone, sand and gravel	31	44	75
Roofing and roofing materials	11	19	30
Sash, doors and blinds	19	16	35
	170	312	482
Coal and wood	126	79	205
Cleaning (and dyeing, rugs, pneumatic)	17	12	29
Clocks and watches	12	5	17
Silverware and jewelry	2	12	14
	14	17	31
Cigars and tobacco	11	20	31
Confectionery	19	26	45
Ice cream	5	4	9
	24	30	54
Department stores	59	64	123
Dry goods	27	58	85
Clothing and underwear	38	130	168
Boots, shoes and rubbers	14	35	49
Hats, caps and gloves	7	19	26
Men's furnishings	4	21	25
Millinery, trimmings and notions	13	41	54
	162	368	530
Drugs and chemicals, druggist's supplies	32	34	66
Electrical machinery and apparatus	27	30	57
Furniture, beds and bedding	93	89	182
House furnishings	10	11	21
Rugs and carpets	4	16	20
	107	116	223
Florists and florists' supplies	10	18	28
Seeds and nurserymen	8	9	17
	18	27	45
Groceries and grocers' supplies	101	132	233
Flour and milling	34	27	61
Canning	6	6	12
	141	165	306
Heating and ventilating	5	11	16
Stoves and furnaces	16	10	26
Steam fitting and fittings	4	4	8
Plumbing and plumbers' supplies	26	50	76
	51	75	126
Ice, cold storage and refrigerators	15	18	33
Importing and exporting	3	55	58
Iron, steel and other metals	50	82	132
Structural steel	4	5	9
Metal manufacturing	41	79	120
Hardware	59	72	131
	154	238	392
Leather, trunks, leather goods	20	36	56
Laundry and laundry supplies	14	20	34
Soap	5	11	16
	19	31	50
Light, heat and power companies	123	132	255
Lumber	127	136	263
Lumbering	4	4	8
Millwork	12	11	23
	143	151	294
Machinery and belting	72	75	147
Machinists and boilermaking	8	17	25
Engines, elevators, fans and blowers	14	11	25
Tools	13	13	26
Foundries	24	29	53
	131	145	276
Meats	26	38	64
Meat packing and packers' supplies	32	10	42
	58	48	106
Milk, dairies, butter and cheese	35	26	61
Mineral, spring and soda water, and supplies	22	26	48
Office machines and supplies	13	11	24
Blank books, stationery, periodicals	5	15	20
Safes	1	..	1
	19	26	45
Municipalities	86	69	155
Municipal officials	203	186	389
Paper, paper boxes, tags and labels	33	78	111
Paving and paving materials	14	11	25
Paints and varnishes	29	32	61
Painting and decorating, and supplies	14	10	24
Oils and grease	21	23	44
Wall paper	8	5	13
	72	70	142
Pianos and musical instruments	14	35	49
Produce and commission	43	74	117
Printing and publishing, supplies	58	86	144
Ink and type founding	5	1	6
Engraving, electrotyping, lithographing	15	11	26
	78	98	176
Railroad (steam) companies	49	26	75
Railroad cars, equipment and supplies	22	15	37
	71	41	112
Rubber goods	10	25	35
Storage and moving	61	56	117
Expressing	42	54	96
Teaming and delivery	49	58	107
Livery	9	2	11
Wagons, carriages and parts	19	14	33
Hay, grain, feed, harness and shoes	20	23	43
	200	207	407
Textiles and dyeing	9	134	143
Telephone service	13	1	14
Undertaking, caskets, cemeteries	12	27	39

Accessory Exhibitors Signed for Chicago's Show

ACCESSORIES
COMMERCIAL VEHICLE SECTION
PASSENGER VEHICLE SECTION

Coliseum Gallery

Havoline Oil Co.....New York
Chicago Drop Forge & Fdy. Co.....Chicago
Rutenber Motor Co.....Marion, Ind.
Imperial Brass Mfg. Co.....Chicago, Ill.
Standard Roller Bearing Co.....Phila., Pa.
Atwater-Kent Mfg. Wks.....Phila., Pa.
C. F. Ham Mfg. Co.....Rochester, N. Y.
Lefever Arms Co.....Syracuse, N. Y.
Globe Machine & Stamping Co.....Cleveland, O.
U. S. Light & Heating Co.....New York
N. Y. & N. J. Lubricant Co.....New York
Weed Chain Tire & Grip Co.....New York
Vesta Accumulator Co.....Chicago
Whitney Mfg. Co.....Hartford, Ct.
Heinze Electric Co.....Lowell, Mass.
Warner Instrument Co.....Beloit, Wis.
Ajax-Grieb Rubber Co.....New York
A. O. Smith Co.....Milwaukee, Wis.
McCord Mfg. Co.....Detroit, Mich.
Republic Rubber Co.....Youngstown, O.
Joseph Dixon Crucible Co.....Jersey City, N. J.
Hyatt Roller Bearing Co.....Newark, N. J.
Motz Tire & Rubber Co.....Akron, O.
Wm. Cramp & Sons Ship & Eng. Bldg. Co.Phila., Pa.
Timken-Detroit Axle Co.....Detroit, Mich.
Timken Roller Bearing Co.....Canton, O.
Fisk Rubber Co.....Chicopee Falls, Mass.
Badger Brass Mfg. Co.....Kenosha, Wis.
Goodyear Tire & Rubber Co.....Akron, O.
Veeder Mfg. Co.....Hartford, Ct.
U. S. Tire Co.....New York
Gray & Davis.....Amesbury, Mass.
B. F. Goodrich Co.....Akron, O.
Standard Welding Co.....Cleveland, O.
National Tube Co.....Pittsburch, Pa.
Motsinger Device Mfg. Co.....Pendleton, O.
Warner Gear Co.....Muncie, Ind.
Spiltdorf Electrical Co.....Newark, N. J.
Diamond Chain & Mfg. Co.....Indianapolis, Ind.
Vacuum Oil Co.....N. Y. City
American Ball Bearing Co.....Cleveland, O.
J. H. Williams Co.....Brooklyn, N. Y.
A. W. Harris Oil Co.....Providence, R. I.
Hartford Suspension Co.....Jersey City, N. J.
Baldwin Chain & Mfg. Co.....Worcester, Mass.
Continental Motor Mfg. Co.....Muskegon, Mich.
Brown-Line Gear Co.....Syracuse, N. Y.
Spicer Mfg. Co.....Plainfield, N. J.
Weston-Mott Co.....Flint, Mich.
Pittsfield Spark Coil Co.....Dalton, Mass.
Firestone Tire & Rubber Co.....Akron, O.
Auto Parts Mfg. Co.....Muncie, Ind.
Pennsylvania Rubber Co.....Jeannette, Pa.
Remy Electric Co.....Anderson, Ind.
Swinehart Tire & Rubber Co.....Akron, O.
Gabriel Horn Mfg. Co.....Cleveland, O.
Consolidated Rubber Tire Co.....New York
Wheeler & Schebler.....Indianapolis, Ind.
Diamond Rubber Co.....Akron, O.
Westinghouse Electric & Mfg. Co..E. Pittsburgh, Pa.
Electric & Storage Battery Co.....Phila., Pa.
Oliver Mfg. Co.....Chicago, Ill.
S. F. Bowser & Co.....Ft. Wayne, Ind.
Edmunds & Jones Mfg. Co.....Detroit, Mich.
Kokomo Electric Co.....Kokomo, Ind.
Byrne, Kingston & Co.....Kokomo, Ind.
Link-Belt Co.....Phila., Pa.
Stromberg Motor Devices Co.....Chicago, Ill.

Coliseum Annex, Second Floor

*Willard Storage Battery Co.....Cleveland, O.
*Wolverine Lubricants Co.....New York
*Warner Mfg. Co.....Toledo, O.
*Muncie Gear Works.....Muncie, Ind.
*Baldwin Steel Co.....
*Esterline Co.....Lafayette, Ind.
*Texas Co.....New York
*Gemmer Mfg. Co.....Detroit, Mich.
*Edison Storage Battery Co.....West Orange, N. J.
*Stewart & Clark Mfg. Co.....Chicago, Ill.
*Cotta Transmission Co.....Rockford, Ill.
*Royal Equipment Co.....Bridgeport, Ct.
*Briggs Magneto Co.....Elkhart, Ind.
*Buda Co.....Harvey, Ill.
*United Rim Co.....Akron, O.
*Waukesha Motor Co.....Waukesha, Wis.
*American Bronze Co.....Berwyn, Pa.
*Findeisen & Kropf Mfg. Co.....Chicago, Ill.
*National Coil Co.....Lansing, Mich.
*Ross Gear & Tool Co.....Lafayette, Ind.
Kells Mfg. Co.....New York
*Empire Tire Co.....Detroit, Mich.
*New Miller Carburetor Co.....Indianapolis, Ind.
*Detroit Lubricator Co.....Detroit, Mich.
Ingersoll-Rand Co.....New York
*Sheldon Axle Co.....Wilkes-Barre, Pa.
*James L. Gibney Rubber Co.....Phila., Pa.
*Garage Equipment Mfg. Co.....Milwaukee, Wis.
*Gould Storage Battery Co.....New York
*Ignition Starter Co.....Detroit, Mich.
*Empire Tire Co.....Trenton, N. J.
*A. Schrader's Son, Inc.....New York
Herz & Co.....New York
*Pantasote Co.....New York
Cleveland Hardware Co.....Cleveland, O.
*Homo Company of America.....Jersey City, N. J.
*Champion Ignition Co.....Flint, Mich.
*Stutz Auto Parts Co.....Indianapolis, Ind.

Coliseum Annex, Second Floor—Passenger Vehicle Week (Only)

Federal Rubber Mfg. Co.....Cudahy, Wis.
White & Bagley Co.....Worcester, Mass.
Seamless Rubber Co.....New Haven, Conn.
Connecticut Telephone & Electric Co..Meriden, Conn.
Michelin Tire Co.....Milltown, N. J.
McCue Co.....Buffalo, N. Y.
Valentine Co.....New York City
Hoffecker Co.....Boston, Mass.
C. Cowles & Co.....New Haven, Conn.
Lovell-McConnell Mfg. Co.....Newark, N. J.
Randall-Faichney Co.....Boston, Mass.
G. Piel Co.....Long Island City
Dean Electric Co.....Elyria, O.
Kellogg Mfg. Co.....Rochester, N. Y.
Doehler Die Casting Co.....Brooklyn, N. Y.
Racine Rubber Co.....Racine, Wis.
Sparks-Withington Co.....Jackson, Mich.
Lee Tire & Rubber Co.....Conshohocken, Pa.
C. A. Shaler Co.....Waupun, Wis.
J. H. Sager Co.....Rochester, N. Y.
Standard Thermometer Co.....Boston, Mass.
Marathon Tire & Rubber Co.....Cuyahoga Falls, O.
Universal Tire Protector Co.....Angola, Ind.
Walpole Rubber Co.....Boston, Mass.
New Jersey Car Spring & Rub. Co.Jersey City, N. J.
Hess Spring & Axle Co.....Carthage, O.
Endurance Tire & Rubber Co.....N. Y. City
Schoen-Jackson Co.....Media, Pa.
Double Fabric Tire Co.....Auburn, Ind.
Simms Magneto Co.....N. Y. City
Batavia Rubber Co.....Batavia, N. Y.
John L. C. Dykes Co.....Chicago, Ill.
Vorhees Rubber Mfg. Co.....Jersey City, N. J.
International-Acheson Graph. Co.Niagara Falls, N. Y.
Automobile Supply Mfg. Co.....Brooklyn, N. Y.
Leather Tire Goods Co.....Niagara Falls, N. Y.
Adam Cook's Sons.....N. Y. City
Coes Wrench Co.....Worcester, Mass.
*NOTE—Exhibitors occupying space in both the passenger and commercial vehicle sections.

ACCESSORIES—PASSENGER VEHICLE SECTION
First Regiment Armory Gallery

Horseless Age Co.....New York
Perfection Spring Co.....Cleveland, O.
S. Breakstone.....Chicago, Ill.
Arminger Chemical Co.....Chicago, Ill.
Motor.....New York
Mayo Mfg. Co.....Chicago, Ill.
Tuthill Spring Co.....Chicago, Ill.
Barco Brass & Joint Co.....Chicago, Ill.
Peck Wheel Co.....Chicago, Ill.
National Motor Supply Co.....Cleveland, O.
Automobile Journal Pbg. Co.....Pawtucket, R. I.
Vanguard Mfg. Co.....Joliet, Ill.
Racine Mfg. Co.....Racine, Wis.
L. P. Halladay Co.....Chicago, Ill.
Motor Car Publishing Co.....Kansas City, Mo.
Brown Co.....Syracuse, N. Y.
S. K. F Ball Bearing Co.....New York
E-C Sales Co.....Chicago, Ill.
N. Y. Coil Co.....Chicago, Ill.
Grip Nut Co.....Chicago, Ill.
Rhineland Machine Works Co.....New York
Marburg Bros., Inc.....New York
Economy Equipping Co.....Chicago, Ill.
Pittsburgh Model Engine Co.....Peru, Ind.
Sarco Engineering Co.....N. Y.
William L. Tobey.....Boston, Mass.
Metal Stamping Co.....Long Island City, N. Y.
E. Edelmann & Co.....Chicago, Ill.
Norma Co. of America.....New York
Illinois V Ray Sales Co.....Chicago
Charles O. Tingley & Co.....Rahway, N. J.
Morrison-Ricker Mfg. Co.....Grinnell, Ia.
Chilton Co.....Phila., Pa.
Motor Age.....New York
Longdin-Brugger Co.....Fond du Lac, Wis.
Automatic Motor & Enginering Co.....Chicago
U. S. Ball Bearing Mfg. Co.....Oak Park, Ill.
Northway Motor & Mfg. Co.....Detroit, Mich.
Automobile.....New York
Motor Vehicle Publishing Co.....New York
Motor World Publishing Co.....New York

COMMERCIAL VEHICLE SECTION
First Regiment Armory Gallery

Horseless Age.....New York
Perfection Spring Co.....Cleveland, O.
Merchant & Evans Co.....Phila., Pa.
Federal Chain & Mfg. Co.....Springfield, Mass.
Motor.....New York
Highland Body Co.....Elmwood Pl., O.
Tuthill Spring Co.....Chicago, Ill.
Service Recorder Co. of Ill.....Chicago
Detroit Puncture Co.....Detroit, Mich.
Never-Skid Mfg. Co.....New York
Sewell Cushion Wheel Co.....Detroit, Mich.
Automobile Journal Publishing Co...Pawtucket, R. I.
Rhineland Machine Works Co.....New York
Marburg Bros., Inc.....New York
Economy Equipping Co.....Chicago, Ill.
Pittsburgh Model Engine Co.....Peru, Ind.
Sarco Engineering Co.....New York
Semple S. Scott.....Chicago, Ill.
Rich Tool Co.....Chicago
Harrow Spring Co.....Milwaukee, Wis.
Cleveland Worm & Gear Co.....Cleveland, O.
Norma Co. of America.....New York
Lavigne Gear Co.....Corliss, Wis.
Polack Tyre & Rubber Co.....New York
Torbensen Gear & Axle Co.....Newark, N. J.
Chilton Co.....Phila., Pa.
Motor Age.....New York
Philadelphia Storage Battery Co.....Phila., Pa.
Automatic Motor & Engineering Co.....Chicago, Ill.
Automobile.....New York

Machine Tools Interest Industry

Merle L. Downs, secretary of the Automobile Board of Trade Show Committee, has returned to New York after a trip through the Middle West devoted to the project of holding an exhibit of machine tools in connection with the coming national show in New York. Mr. Downs stated that not over six manufacturers had been signed up for the show but that there are prospects for a considerable representation despite the shortness of the time that is still available.

The show situation is somewhat complex as regards machine tools. The contemplated exhibit will be the first to be held in this country and its announcement attracted a large amount of attention throughout the industry. At the Olympia show there was such an exhibit and it proved to be one of the most interesting features of the show. But the manufacture of machine tools is largely on order, little stock being maintained. Thus, the difficulty that stands in the way of a complete exhibit in January is that available machines will be hard to get.

Coker F. Clarkson, general manager of the Society of Automobile Engineers, declares that a complete exhibition of machine tools would be interesting to the whole industry and that the S. A. E. was strongly in favor of adding such an attraction to the national show.

Atlanta Show Makes Much Money

ATLANTA, GA., Nov. 25—The Atlanta automobile show ended Saturday night. The accounts have not been cast yet, but it appears that enough money will be in the treasury to pay all expenses, refund to each exhibitor half the money he spent for space and will still leave $2,500 for a working fund.

The show was more economically run this year than last, but, thanks to good weather, to prosperity in the South, to the fine display of cars and to much publicity, and because it was given right at the start of the Southern buying season, it drew immeasurably larger crowds than ever before.

Senators To Hold Automobile Show

WASHINGTON, Nov. 25—Washington is to have an automobile show early in the new year which promises to eclipse any ever given in the national capital. T. Oliver Probey, president of the Michigan Motor Company, and proprietor of the Probey Carriage Company, will be the executive chairman of the show.

Committees will be appointed within the next 2 weeks to aid Mr. Probey in his work. The dates for the show have been decided upon. It will begin February 3, and last 1 week. The show will be given in Convention Hall. It has been 2 years since Washington had an automobile show.

To Oust Unhandy Manograph German Savant Builds Mechanical Indicator So Small and Rigid as to Shake with Motor but Never Alone—The Diminutive Diagrams Enlarged at Leisure—A Popular Pyroscope—Carbureter Construction

INDICATOR for High-Speed Motors—When the customary indicators are used for registering pressures and piston speeds in automobile engines the results are not satisfactory, and this accounts for the fact that these instruments are rarely used by automobile manufacturers, though they are found indispensable in the development of new designs or modifications of larger and slower motors. In recording pressures, the masses of the movable parts of the instrument—the pistons and the writing stylus—are subject to disturbing independent vibrations in the higher degree the larger and the more rapid the variations in pressure are in the machine under test. The shorter the duration of these independent vibrations, which are due to the intrinsic mechanical properties of the measuring instrument, can be made, the more accurately the true course of the variations of pressure can be recorded. To attain accuracy, the movable masses and their movements must both be reduced to a minimum. On this principle the change was made from the simple Watt indicator to the short-stroke instrument with a mechanically magnified movement for the stylus and finally to the optical indicators or manographs which work with exceedingly small masses. But with the latter it is necessary to use photographic registrations, and this feature renders them less practicable, as it is difficult to obtain sharp lines of even thickness, while the photographic plate is also underexposed when the light moves rapidly and overexposed when it moves slowly. Moreover, the whole process is laborious and does not admit of taking diagrams in rapid succession.

In applying the customary instruments to the recording of piston speeds, it has been considered most important to have a mechanism which could be attached quickly to the motor—as by belt drive—and one which was kinematically correct in principle, and less attention has been paid to the need of having it able to cope with the accelerations arising in its use at high motor speeds. Not only the drive must not break but it must also transmit the movements without gross errors. In order to meet this requirement the drive must be rigid.

Basing his efforts on these ideas Dr.-Engineer O. Mader, of Aachen, has aimed to build a new kind of indicator, which he terms the Mikro-Indicator, and the manufacture of it has been undertaken by Stärzl Brothers, 18 Kapuziner strasse, Munich. This instrument is supposed to be sufficiently accurate at motor speeds up to 2,000 revolutions per minute; to admit of taking diagrams in rapid succession; to produce diagrams which are visible at once, permanent and susceptible of manifolding; to be easily operated and not to be sensitive to rough handling. Different views of the construction are shown in Figs. 1, 2 and 3, while a diagram of the registering method is shown on a larger scale in Fig. 4. It is similar to the early indicators in this that the diagram is drawn direct from the movements of the indicator piston, and in this case by means of a sharp steel point which traces the curve on smoked glass, but the stroke of the indicator piston is reduced to a maximum of 2 millimeters, and the magnifying of the very small diagram thus produced is done subsequently under a microscope, thereby circumventing the disturbing influence of the motor move-vibrations on the magnifying process.

The drawing of the motor piston stroke is effected by a lateral movement of the light stylus. The indicator piston has a flat top A, Fig. 4, on which the circular disk forming the end portion of a small lever B may slide. The stylus S extends from the center of the disk. The other end E of lever B is drawn to and fro by the oscillation of a crankarm C on spindle D. A fine spring F holds B down to steady contact with A and obviates lost motion in the joints.

The indicator piston is guided below by the cylinder wall G, Fig. 2, and above by securing the hollow piston rod to the double, oppositely-wound spring H. These three parts—piston, piston rod and spring—form a unit and must be replaced as such, if it is desired to change the dimensions of the diagrams. The area of the piston is normally 1 square centimeter for pressures up to 30 atmospheres and proportionately smaller for higher pressures.

The stopcock J and a water-cooling chamber are built into the body of the indicator cylinder, the provision for cooling being needed only when the cooling system of the motor is inefficient at the point where the indicator is screwed in. By this compact design the tubular connection with the interior of the motor is made short and unobstructed, and the bore of it represents an addition of only 3 cubic centimeters to the volume of the motor under test.

The diagram-plate-carrier is a U-shaped frame pivoted upon a fixed shaft K and pressed by a spring L against a round eccentric cam M. Into this frame the smoked glass plate is inserted from above together with a backing plate, and both are held by leaf springs in any position given them. With one quick turn of the cam, by means of a crank, the glass plate is pressed lightly against the stylus and is again immediately drawn back.

If another diagram is to be taken, the plate is raised by turning the knob O. In this manner 24 diagrams can be taken on one plate in two rows, in 30 seconds if necessary. To start the second row, the plate is pushed to one side on the shaft K. The glass is a 28 by 48 millimeter plate, as commonly sold in the open market for microscopic preparations and germ cultures.

A simple drive with few joints is preferably used for actuating the micro-indicator; for example a walking-beam drive as indicated in Fig. 5. In this matter it is of the greatest importance that the bearings of the drive, as well as the indicator, follow all the vibrations of the motor. While the walking-beam drive is not kinematically uniform, the errors arising from this fact, and especially from the limited length of the beam, may be obviated largely by shortening the ecentric arm. In using this drive, it is advisable always to use the same crankarm length (45 millimeters), whereby the variations of the radius of the eccentric may be held within narrow limits (from 13 to 15 millimeters). The only parts which must be provided especially

for each kind of motor is the driving crank, or eccentric, and the middle portions of the beam, for which parts, therefore, very simple forms have been chosen.

So as to be able to stop the movement of the writing lever—to replace a dulled stylus, for example—a coupling is provided for this lever which has no lost motion and which, it has been found, may be easily secured or released by hand even at the highest motor speeds.

The adjustment of the drive must be made with the greatest care, to avoid large errors in the diagrams. At a certain position of the piston—selected at the middle of its stroke and not at the dead center—the stylus must mark the same spot when going to the left as when going to the right.

THE ENLARGEMENT OF THE MINUTE DIAGRAMS

An ordinary microscope magnifying 40 times is used for obtaining an enlarged view of the diagrams. Mere observation of the diagram in the microscope is sufficient for guidance in the adjustment of valve cams and ignition. To permit the measuring of diagrams, however, they must be enlarged either by means of an ordinary enlarging-camera or by drawing an enlargement by hand with the aid of a special device furnished with the microscope. The latter is operated at an angle of 45 degrees, and the device consists in an arrangement of small reflectors in the under-part of the sight tube, near the ocular, by which the image of a blank drawing-surface—which is located directly beneath the ocular and conveniently to the operator's hand—is thrown into the plane of the enlarged image of the diagram, so that the operator sees both at the same time. This enables him to follow the lines of the enlarged image with a pen on the actual drawing-surface.

To define the scale of enlargement which has been used in representing the motor movements and pressures in the diagram, both the magnification and the resistance of the indicator spring are to be considered. The magnification is verified by a scale traced on glass, and it remains constant. The spring action is determined by a convenient pressure gauge operated with weights, as represented in Fig. 6.

The principal use for the micro-indicator lies in its handiness for determining the mean effective pressure and separating the thermic from the mechanical elements in the efficiency of a motor. The author refers to a number of determinations of this nature which he has made with the instrument of his design and by which its superiority in accuracy over old-style mechanical indicators is borne out. Its superiority over the manograph lies mainly in its convenience, robustness and the sharp and permanent lines of the diagram.

Among other uses, there may be mentioned the adjustment of valve cams and ignition, the determination of the time required for ignition and flame propagation, the measuring of compression and of possible leaks, estimates of strangulation in intake and exhaust pipes and valve ports, as well as of the nature of the combustion and the quality of the carbureter.—From excerpt in *Der Motorwagen* of September 30 of article first appearing in *Dingler's Polytechnisches Journal*.

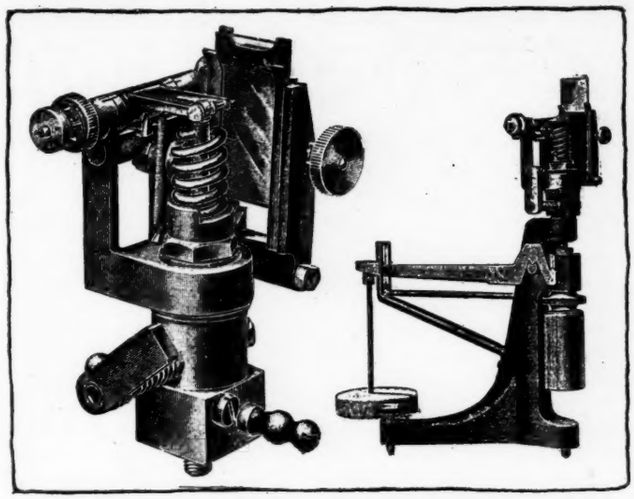

Fig. 1—Mader micro-indicator. Fig. 6—Spring pressure gauge

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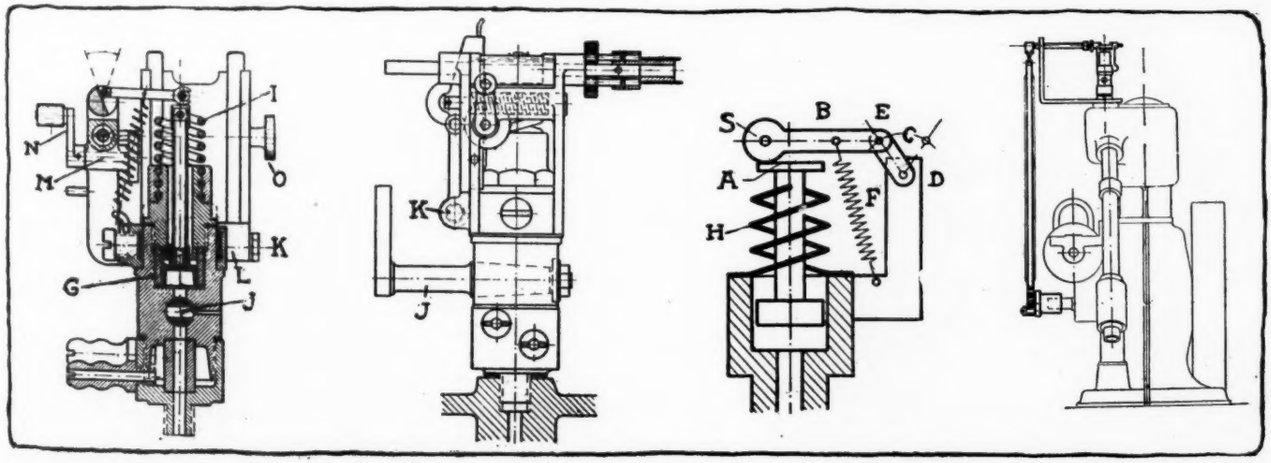
POPULAR Pyroscope—Among instruments which compete for ordinary industrial purposes with the scientific optical pyrometers, as well as with the electric instruments, one of interesting simplicity is mentioned as in use in some German factories. In general appearance it may be described as a kerosene lamp with a metallic and enlarged chimney to the side of which a short telescope is attached. The rays from the kerosene flame pass horizontally through a multiple diaphragm composed of a number of transparent films which are colored differently, so that the diaphragm as a whole presents a scale of colorations which in combination with the light from the kerosene flame correspond to the heat colors of steel from 650 deg. to 1650 deg. C. Obliquely in the telescope tube there is placed a small mirror which reflects the rays from the lamp, transmitted through one of the films, to the eye of the observer and makes this image appear as a round spot on the light image of the heated piece of work which is seen direct through the telescope. By turning a knurled disk the diaphragm is turned around until the particular film is in line which gives a light that disappears on the image of the work, for lack of contrast, and a hand is at the same time moved around on a



Figs. 2 and 3—Different views, partly in section, of Mader micro-indicator. Fig. 4—Diagram of the recording mechanism. Fig. 5—Mounting and walking-beam drive of Mader instrument

drum inscribed with a scale of temperatures. The moment the correct position is found the temperature of the work can thus be read offhand. The accuracy depends upon the division of the scale, but also upon the constancy and light of the kerosene flame. Considerable attention must be given to the cleaning of the lamp burner and the regulation of the flame. The latter should have a certain height, for example 18 millimeters.—From *Der Praktische Maschinen-Konstrukteur*, September 19.

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LATEST G & A Carbureter—Most of the design features in a new model of the Grouvelle & Arquembourg carbureter may be discerned by a glance at the accompanying illustration, Fig. 7. The large jet G is oblique, which arrangement facilitates adjustment and inspection and especially the adaptation of the same carbureter model to different motor sizes and motor designs, by modifying the holes at G. The additional air intake operates automatically by means of metal balls resting over the air holes, which means that the mixture is determined not only by the position of the throttle but also by the motor speed, and mainly by the latter. The throttle is closed completely when the lever M is in position 1, so that no gasoline is used when the vehicle is running downhill by gravity. In positions 2, 3 and 4 of lever M, the suction is switched by way of the groove *k* in the throttle body into channels *a* and F, drawing air from around the small jet *g* and gasoline from the latter. In position 4 the large jet also begins to act. The small tubular jet *g* passes through the middle of the float and acts as the stem for the needle valve. Two holes *r*, near the bottom of the float chamber, admit the gasoline to its interior. A hot-water chamber R, connected with the cooling-water system, assists in evaporating the spray from this jet.

The working parts of this carbureter are easily taken apart and reassembled without the use of tools. The wing nut L gives complete access to the main jet. By pressing down on the yoke N, against spring J, the tube F is released, and then, by the extension of the spring, the pin H is released also, permitting the yoke N to be turned around the housing of the priming-rod P. Now the cover of the float chamber comes off, and the jet *g* with the weights C and the float can be removed if desired. Also, with the cover removed, the action of the needle valve may be regulated, the weights being secured to the jet tube and not to the cover.—From *Omnia*, November 2.

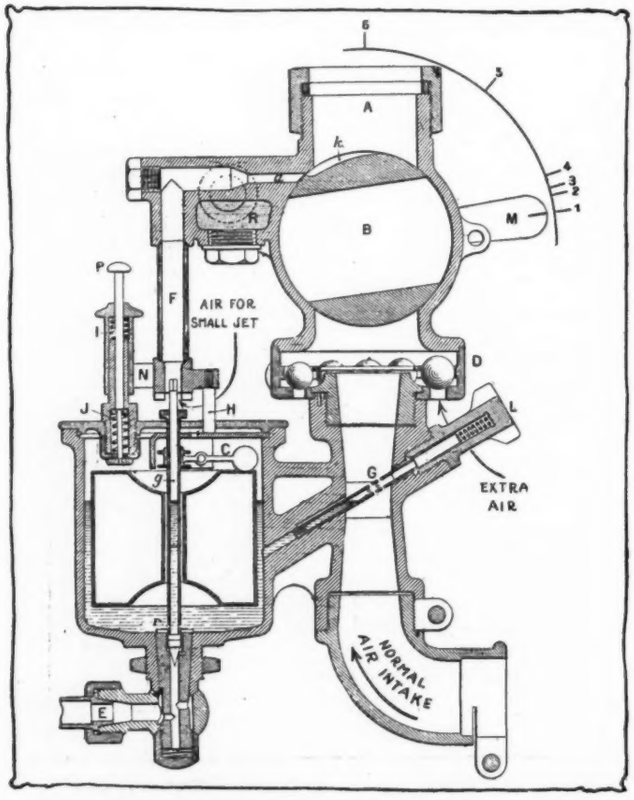

Fig. 7—New model automatic double jet G and A carbureter

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MACHINES to Test Skill—As a consequence of the world-wide movement started by Frederick W. Taylor for increasing the efficiency of traditional working processes through analysis of the movements composing them, Professor Imbert, of the University of Montpelier, has devised a number of ingenious devices by which various kinds of common work may be measured with a view to determining what wages each of the working operations ought to command, and the French government has thereafter subsidized further experiments in the same line. Similar small machines have been made by which, for example, the skill of a workman who applies for a job may be put to a decisive and impartial test. In the case of filing or the cutting of metal sheets these devices furnish diagrams of the work done by each hand, of the vertical movements as well as of the horizontal ones and of the pressure exerted at any point of the stroke of the file or the shears, and by comparing the diagrams produced by a skilled workman with those produced by one whose skill is less well known the value of the latter as a workman can be gauged without the need of watching him. The speed is also recorded.—From illustrated article in *Werkstattstechnik*, October 15.

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ALTERNATING Shows in Paris—The Association of French Automobile Manufacturers (*Chambre Syndicale de l'Automobile*) under the leadership of Marquis de Dion, has resolved that it is desirable to hold an automobile salon in Paris every year but that it is equally desirable that constructors in each main branch of automobile manufacture should not be called upon to develop and exhibit important improvements oftener than every two years, and that, therefore, one of two successive annual shows should comprise pleasure automobiles, vehicle bodies, bicycles, motorcycles and accessories, and that the other should be limited to commercial motor vehicles, motor boats and machine tools. If, however, the makers of accessories should express a preference for participating in both shows, the opportunity should be held open for them. The proposition is meeting with general approval though some dissenting voices are heard.—From *L'Auto*, November 7.

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INTERNATIONAL Influences—At the Olympia automobile show there was seen on the stand for Charron cars one of these fashionable French vehicles equipped with a Lentz hydraulic transmission. The latter, according to *L'Auto*, of November 13, was considerably improved as compared with the form in which it first made its bow to the public. Though a German construction it was received with favor in England and by this route seems now to be in a fair way to win French approval. It was described in THE AUTOMOBILE of May 30.

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GRAND Prix for 1913—The Automobile Club of France decided at a meeting held November 6 that a *grand prix* race shall be held in France in 1913, whether the number of entries received before December 31, 1912, comes up to the expectations or not. The decision was taken in order to justify manufacturers in making their preparations for the event well ahead of time.—From *L'Auto*, November 7.

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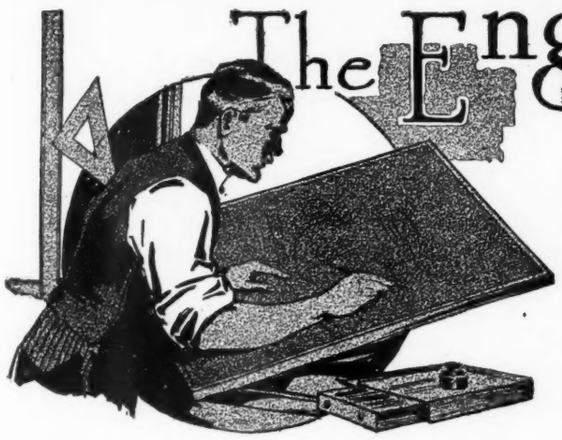
SPLASH Guards—The second public competition for splash guards in Paris has been held, but the press refuses to take the new accessory seriously. It is not too much to ask that streets should be kept so clean as to render splash guard unnecessary, comments *Omnia*.

The Engineers' Forum



3-Point vs. 4-Point

Discussion of Relative Merits of These Systems for Supporting the Motor and Gearbox

Van Dervoort Lays Stress on Alignment—Birdsall Finds Both Systems Satisfactory

Part III

W. H. Van Dervoort Prefers Three-Point Suspension

Edward T. Birdsall Finds That Both Types Have Advantages

EAST MOLINE, ILL.—Editor THE AUTOMOBILE:—We started in at accomplishing what we now get in our three-point motor suspension—the alignment of transmission and motor by preventing the distortion of the frame as much as possible, through the use of the three-point spring suspension. We were among the first of the American manufacturers to adopt the unit power plant and with the adoption of this unit power plant we discarded our three-point spring suspension and went to the three-point power plant suspension, as in the unit power plant it is absolutely necessary to maintain perfect alignment of the motor and transmission shafts, and inasmuch as as it is not practical in the light-weight construction of automobile power plants to make the parts sufficiently rigid to withstand the severe cramping due to operating a car over unequal surfaces, the necessity for overcoming these strains as much as possible by the use of the three-point suspension for the entire power plant is apparent.

I feel there are some advantages to the four-point motor suspension when used in connection with an independent transmission, where perfect alignment between transmission and motor is not imperative.

In our earlier construction we used two points of suspension at the front end of the motor with a single point at the rear end of the transmission. Our present construction gives the single point of suspension at the front end of the power plant and the double point of suspension at the front end of the transmission, allowing the transmission to overhand the rear supports. This makes possible a very considerable reduction in the weight of the connecting link between engine and transmission, and inasmuch as we advocate an open flywheel housing instead of a closed flywheel housing, this is a point of considerable importance to us.—W. H. VAN DERVOORT, Moline Automobile Company.

DETROIT, MICH.—Editor THE AUTOMOBILE:—As to the relative merits of three- and four-point suspension I believe that three-point suspension is more necessary where a main frame construction is used than in the case of a subframe design. I rather favor the three-point for both pleasure and commercial cars, although I have yet to experience any trouble with the four-point, providing the strains are properly taken care of.

On commercial cars I would use the three-point suspension on account of the added assurance of freedom from possible trouble due to the gross misuse that the average truck gets from careless or ignorant drivers.

Then, again, there is the selling department's talking points to be considered, which often have a serious influence on design.

At the present time I have three pleasure cars and two trucks on the boards and they are all of main frame three-point construction.—EDWARD T. BIRDSALL, Consulting Engineer.

MARTIAN HEIGHTS, N. Y.—Editor THE AUTOMOBILE:—By triangulated trussing, stresses are transferred from joints to the material of struts and stringers, roughly speaking, but this undoubted virtue of the triangle wherever joints are most likely to constitute the weak points is not utilized much in automobile construction. The corner gussets of the frame are placed as disadvantageously as possible, for example. In my opinion 3-point suspension has no value apart from the construction together with which it is used. It may be advisable with one, inadvisable with another. If it were true that a 3-point cradle supporting the motor would conform to any position into which those three points in the automobile frame at which it is supported may be forced, a certain advantage relating to the protection of the motor would be realized, but, even when double-swiveled at one of the points, it does not do so. In the case of whipping or bending of the frame the mutual relations of the three points are changed, and the cradle is cramped to resist this deformation. It is only in the case of symmetrical torsion of the frame that the cradle hung at three points is relieved of stresses in higher degree than one hung at four points. The cradle must, then, after all be made strong enough to resist and prevent certain deformations of the frame, or else the suspension at the most exposed point, and possibly at two of them, must be made flexible in all three dimensions. On the other hand, a four-point cradle can more readily be made rigid against whipping and pitching stresses and can also be flexibly supported, with sufficient yield to allow for torsion, provided the frame construction and the spring suspension of the vehicle are designed with a proper degree of rigidity, considering the other purposes which they have to serve—for example that of carrying a vehicle body with doors and windows which should fit and operate flawlessly.

If it may be assumed that the art of automobile building has advanced to a point where it cannot be accepted as satisfactory engineering to protect the motor at the cost of neglecting other important requirements, it seems hard to find even an excuse for hanging the biggest weight in the whole construction at the smallest possible number of points. It stands to reason that, so suspended, it may contribute to the aggravating of frame deformation rather than to the checking of it, notably in all cases where the suspended unit rocks freely without being subjected to internal stress.

The subject is, however, much too large to be covered convincingly in a few lines.—UNATTACHED S. A. E. MEMBER.

Hansom Type Coupé for E.M.F. Chassis

Compactness and General Design Are Especially Suitable for a Runabout Chassis

By George G. Mercer

THE accompanying scale drawings show a light-weight coupé body adapted from the lines of the well-known horse-drawn hansom cab, and suitable for service on a small runabout chassis. Such a body design would adapt well to the chassis of the E.M.F. 30 roadster, and this car has therefore been chosen as a basis of illustration.

The hansom cab is probably the most compact two-passenger vehicle that has ever been generally used, and its general design is for this reason especially suitable for application to a small chassis where light weight is an important consideration.

The E.M.F. 30 has a wheelbase of 112 inches, with a 4 by 4.5-inch motor and tires of 32 by 3.5 inches. This car is regularly equipped with three or more styles of bodies. The illustrations show the roadster model with the body removed and the proposed coupé body set in its place. The gasoline tank, tool box and tire carriers remain at the rear undisturbed, and the wheel guards are also untouched.

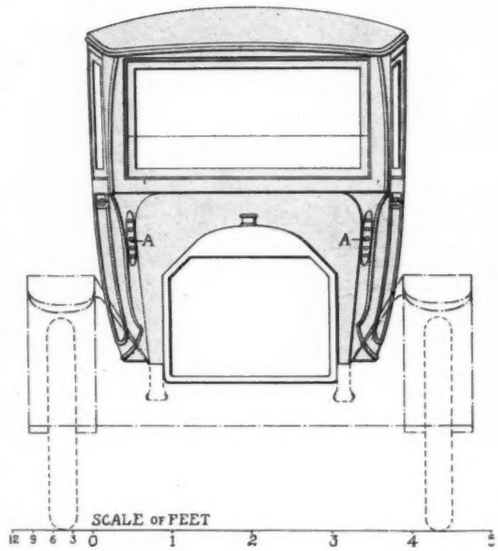


Fig. 1—Front view of E.M.F. coupé design

In its standard form the E.M.F. runabout is arranged for right-side driving, and owing to the fact that the change gear and brake levers are set well within the frame for operation on the inside of the foredoor, no changes are necessary and therefore no expense is incurred in order to prepare the chassis for the reception of the new coupé body.

Fig. 4 gives a good general impression of the body mounted. It may be of interest to point out that in actual dimensions the body is smaller than appears at first sight, this effect being produced by a full extension of the roof at the front, and also by carrying the forward moulding at the bottom well in advance of the door. Constructed as shown, this body should not exceed the weight of the stock roadster body by more than 450 pounds.

All the most important measurements are indicated in the drawings. As shown in Fig. 4, the width of door over mouldings is 20 inches while the extreme length of the body from front to back on the belt line is only 39 inches. The distance from the dash to the front of the seat cushion is the same as on the roadster, as also is the height from the floor to the top of the cushion. The vertical distance between the cushions and the underside of the roof is 39 inches, and the width of the cushion, shown on the plan, Fig. 2, is 37 inches. The space between the steering wheel and the seat back is approximately 15 inches. These interior measurements afford ample accommodation for two average people.

The exterior dimensions of the body are: length 50.5 inches by 47 inches wide. The construction is combination wood and metal panels with wood framing, the lower body and door panels and the cowl being formed of metal. Steel can be used to advantage for all these panels except the cowl, though by so doing the weight of the body would be slightly greater than with all aluminum panels. The upper body panels, side and rear are .375-inch thick whitewood, and the roof panel is either pine sheathing or laminated wood roofing. The rounded corner at the rear is formed with the framing pillar, and the side and back panels, both upper and lower, do not follow around the corner and intersect, but terminate at the moulding line indicated on the two views Figs. 3 and 4.

As indicated by dotted lines in Fig. 4, the location of the levers permits of easy entrance from either side. The space on

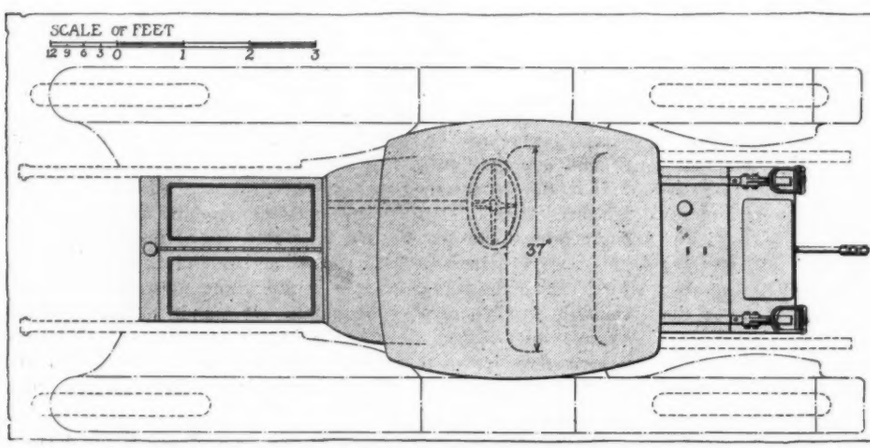


Fig. 2—Plan view of suggested E.M.F. hansom type coupé

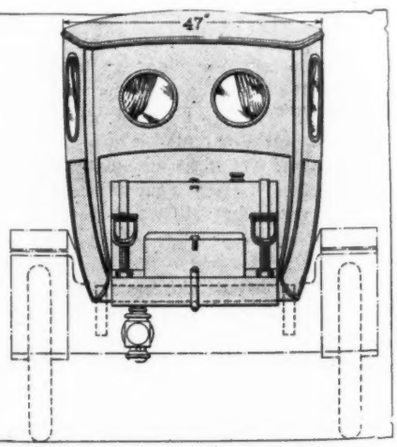


Fig. 3—Rear view of E.M.F. coupé

the chassis occupied by the body extends from the dash to the block that supports the tank at the rear without disturbing the latter. Regarding the dash, the best plan is to have this made integral with the body. It costs a little more for a new dash and installing it on the car, but it effectively prevents the rain leakage around the joint of the moulding, that is apt to occur if the dash is not built solid with the cowl.

Plate glass windows with mahogany wood frames, are fitted to the doors, provision being made for opening by dropping their full length. The oval lights on the sides and the round ones at the rear are made stationary and metal tee mouldings are used around the openings to keep the glass in position and to serve as a finish.

Ventilation is secured by dropping the door windows, or opening the front windshield visor which is indicated in Fig. 4. In addition there are two elongated openings, marked A on Figs. 1 and 4, that are controlled by shutters operated from the inside of the car.

The lamps used are those furnished with the stock car, the only ones disturbed in mounting the new body being the dash lamps, and these are reassembled on the car in their former positions. The horn is located under the engine hood and does not call for any interference.

For the exterior finish different shades of green combined with either yellow, or white or black are good suggestions, and some of the brown shades combined with black are also very suitable. Interior trimmings chosen to match whichever of these combinations is adopted will look and wear well.

The most economical color to use, however, will be the standard color on the stock car, as this well save repainting the chassis to match, provided the paint is in good condition. Assuming that this latter decision is made, the lower body panels and the cowl will be blue, as will also the recessed panel that forms the rounded corner at the rear. This will be blue the entire length from top to bottom and between the mouldings that mark the end of the side and back panels. The mouldings will be black and also the roof and the upper panels above the belt. Black should also be used for the underside of the roof where it projects forward of the windshield.

The exterior color scheme is therefore the same as the stock body, blue with black, hair line gray striping and gray wheels.

If a cloth is decided on for the interior finish a gray to match the color of the wheels and the striping could be introduced with pleasing effect. Cloth is certainly better for trimming the interior of a winter car body than leather, all things being equal. There is a coziness and warmth to cloth that no leather can give.

The most durable cloth materials in the lighter shades are the cords, either whipcord or the bedford cord and the latter seems to be most generally favored. Among the gray bedford cords it is common practice to use a fleck or marking of some darker shade, and a gray with a black fleck will suit admirably for trimming the seat, the sides and back of the seat, the body and roof. The broad lace used on the doors, and the finishing lace would of course be chosen to match the interior scheme of color, as also should the floor carpet. Suitable curtain material would be plain gray silk, the doors being mounted on spring rollers while those on the side and back windows could be draped and held in place with a cord.

The appointments will consist of silver mounted electric dome light in the roof, gray morocco covered toilet and card cases, and ash tray for the doors and pockets on each side under the cowl. All metal parts inside silver finished.

Though of compact form the inside dimensions of the body permit of ample thickness in the trimming of the seat back and sides and cushion. For the latter 6 inches is allowed for the depth. A driving cushion does not need to be made too thick. An excess of flexibility in the seat cushion used by the driver, due to the greater length of the cushion springs and consequently greater thickness of the cushion, is undesirable because it gives a rolling motion to the seat. The cushion should therefore be moderately firm and the trimming of the seat back should not be too far removed from the steering wheel. Both the seat back and the cushion should support the driver's body firmly in the position that he is obliged to assume in order to handle the wheel properly. The trimming of the passenger seat can be made more luxurious to suit a more reclining position.

The cost of a body according to the design and specifications above outlined will approximate an outlay of $900. This should insure first-class workmanship and materials and should be of a style and finish to satisfy any reasonably critical customer. This figure includes mounting the body on the chassis ready for service.

On the return of warm weather the old body can be replaced with little trouble, the only expense being that of the actual labor of making the change. By providing himself with this extra body the owner of a small runabout is therefore prepared for comfortable traveling all the year round.

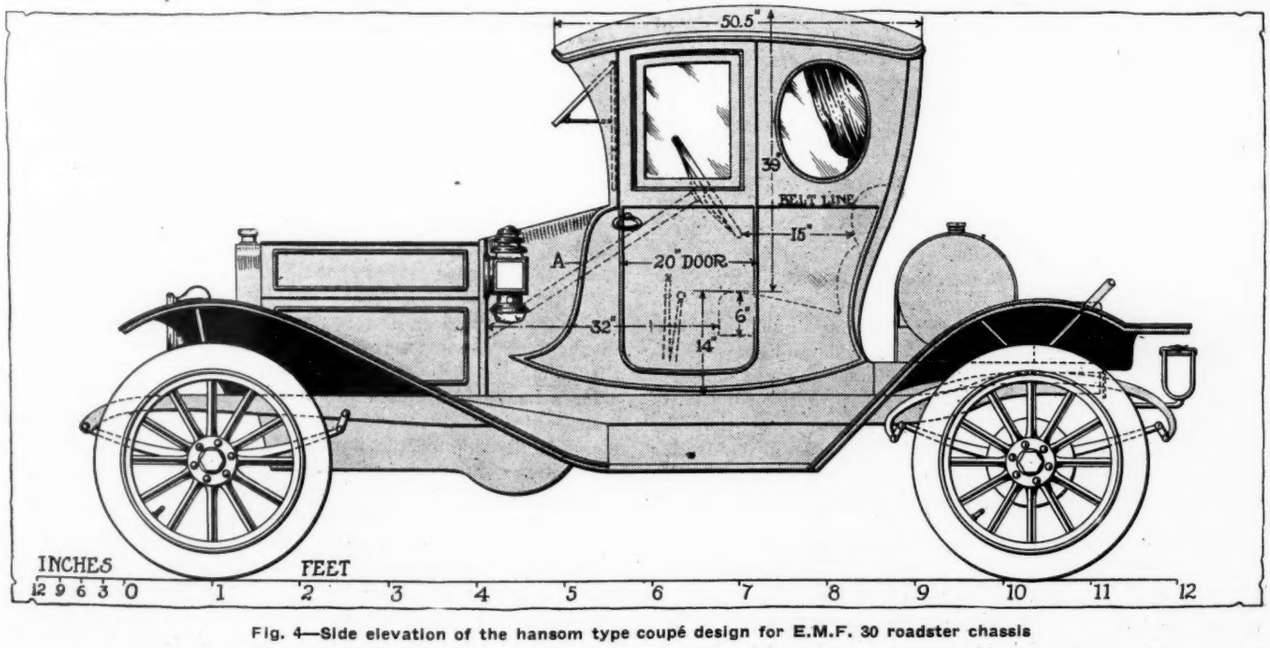


Fig. 4—Side elevation of the hansom type coupé design for E.M.F. 30 roadster chassis

Part II Carburetion

Subject Digest

Carburetion cannot be good unless the liquid fuel be divided into the most minute particles.

When the fuel is not broken into a particularly fine spray or mist the resulting mixture cannot be homogenous.

The particles of hydro-carbon at the center of a fuel globule cannot combine with the oxygen of the air and with a large globule it takes the air longer to reach the center.

Much of the fuel that goes into the cylinder in a liquid state passes out through the exhaust without being burnt. It is thus a dead loss of power and efficiency.

Precipitations are caused by a change in direction of flow; they are minimized by the application of heat.

The rate of flame propagation varies with the homogeneity of the mixture and is more rapid and regular when the surface to volume ratio of the globules of incoming fuel do not vary from one location to another.

by Robert W. A. Brewer

IN Article I, published November 14, it was shown how the addition of heat is necessary in order to effect carburetion, and we will now more carefully consider the question of the homogeneity of an explosive mixture. It is essential that in a gas or vapor engine the working fluid should be supplied to the engine in as homogeneous form as possible, in order that the rate of propagation of the flame through the mixture may be uniform and of a maximum velocity. Particularly is this necessary in high-speed engines where the flame velocity has to be very great in order that the pressure should, as it were, keep up with the piston.

It has been found in practice that **where lack of homogeneity in the mixture occurs, the expansion of the burning gases is erratic, and produces humps on the expansion curve of the indicator card.** Sometimes these humps have been rather difficult to explain, but I think we may take it for a fact that they are due to variations in the stages of combustion of a liquid fuel due to the lack of homogeneity in it. We do not find these humps occurring in gas-engine practice to any marked extent, and where a hump has occurred it has been of a fairly regular formation, and may be due in some instances to the interchange of heat between the burning mixture and the cylinder walls.

We find, however, in an engine burning liquid fuel, that in some cases the hump is most marked, and one of the points which the writer raised in connection with a recent discussion on Herbert Chase's paper before the Society of Automobile Engineers at the June session was that the irregular formation of the indicator card was probably due to the lack of homogeneity in the explosive mixture which was produced by the particular carbureter fitted to the engine.

In further confirmation of this theory, Mr. Chase pointed out that the proportion of air to fuel was abnormally small for a high-class carbureter under testing conditions, and it is very probable that the mixture in this case was too rich on account of lack of homogeneity. That is to say, that certain portions of the mixture were abnormally rich in order that the other portion of the mixture should have the correct ratio of constituents.

It is difficult for our minds to consider the smallness of a molecule, but in the limit we may take it that an ordinary perfect gas is body divided into its finest possible particles. In a hydro-carbon mixture, gas with air, it is obvious, in order that the rapidity of combustion should be insured, that the hydro-carbons must be divided into the finest possible particles so that each molecule of hydro-carbon can combine at the critical moment with its necessary molecules of oxygen.

One of the objects of the carbureter is to break up the fuel into these finely divided particles in the limit into a gas or mist, and any variation from this idea is a step in the downward direction in carburetion. **We come, therefore, to the question of surface to volume ratio, and it is a well-known fact that a sphere presents the smallest surface to volume ratio of any known shape.** If you study the formation which a liquid takes in issuing from an orifice or in moving through space or the atmosphere, you notice that the spherical form is always taken by the particles. **We have, therefore, as a peculiarity of nature, to deal with liquid which naturally presents to us the greatest difficulty with regard to its presentation of surface for the carbureting process.** We ought to divide these globules into the largest number possible in order to present a maximum surface of fuel from which evaporation can take place. **A simple law of mathematics shows us that the relations between the volumes of different bodies are to one another as the cubes of their diameters,** so that if we have a globule whose diameter is 1 in any particular units, and another globule whose diameter is 2, **the latter will contain eight times as much volume as the former.**

The importance of fine subdivision of the fuel in the carbureter itself is thus emphasized, as **it is obvious that those particles of hydro-carbon at the center of a globule cannot combine with the oxygen of the air until they are actually in contact with it.** This means that **the time element is proportional to the size of the globule, and where rapid carburetion takes place, either the subdivision of the fuel must be very fine, or an excess of fuel must be permitted to pass through the carbureter, the external portions of each globule only being correctly mixed with its necessary amount of oxygen.**

In this latter case either the fuel passes as liquid into the engine cylinders and is there burnt, causing distortions of the true expansion curve; or it passes away unburnt to the exhaust. It is my contention that **what I should consider a heavy fuel consumption with the majority of American engines and carbureters, is due to the lack of sufficient subdivision of the particles of fuel in the carbureters** themselves. Furthermore, in many cases, although this subdivision or spraying may take place in the first instance, its effect is nullified by obstacles presented to its path through the carbureter on the way to the engine.

We now come to a very important feature in carburetion, namely, the shape and condition of the flow path between the carbureter jet and the inlet valves. In the first place, there is undoubtedly an awakening in America to the ad-

vantages of the venturi-tube principle, which principle is a very old one in carbureter designs. I had a venturi-tube carbureter fitted on an early Decauville car 11 years ago. At the throat of this tube was a jet of the form of a mushroom valve. This instrument worked perfectly well when in adjustment, the upper taper of the cone in the venturi being 7 degrees.

A butterfly valve was fitted, which was fortunately very thin. **Here we come to the first possible source of trouble in an obstruction, as such an object right across the center of the flow path tends to cause precipitation of the finely divided particles of fuel held in suspension in the air.** At this early stage of the carburetion it can scarcely be said that the fuel is already evaporated, and it is my contention that even **a gauze screen does more harm than good.** Such a device immediately causes precipitation to start, affecting the homogeneity of the mixture by alternations of weakness whilst the liquid is precipitating, and richness when the precipitated liquid is dislodged by the air stream.

Such a state of affairs undoubtedly takes place whenever a change of direction in the flow path occurs, and it can only be minimized by the application of heat. **If heat is applied to a surface which tends to cause precipitation, the liquid on coming in contact with such a surface is evaporated. Modern carburetion owes much of its improvement to this fact,** and there is no doubt that the reason why certain six-cylinder block engines of modern type carburete more easily than the old induction-pipe engines is that **very large heated passages are provided through which the carbureted air has to pass. Such passages, cored in the waterjackets of the engine, form ideal means for carburetion, by reason of the fact that the flow velocity is quickly reduced. A time element occurs in which evaporation can take place, and any precipitated liquid has an opportunity of diffusing throughout the whole mass.**

A controversial point here arises, as to whether it is better to allow the mixture to enter the engine at practically atmospheric temperature, thereby getting the greatest weight of charge into the cylinders every time at full throttle opening, or to allow the mixture to reach a higher temperature, at which it is more perfectly carbureted, although the weight per charge is less.

I certainly am of opinion that the latter is the better state of affairs, as, although the weight of charge may be slightly less, due to its rise of temperature, the more homogeneous mixture in the latter case will burn far more efficiently. By this is meant that **the rate of propagation of the flame through a homogeneous mixture is more rapid and regular than is the case where the surface to volume ratio of the incoming fuel varies from one location to another.** It is a fact that with modern grades of petroleum distillates it is quite possible for the heavier fractions of the fuel to pass through the engine cylinders unburnt, but even if this ultimate state is not reached, retarded combustion takes place, resulting in an unduly high temperature.

(Te be continued.)

Fundamental Principles of Carbureter Adjustment

ADJUSTMENTS on carbureters of all makes follow along the same lines. That is, there is a rational method of procedure, which, if followed, will permit of reaching the required result in a shorter time than if the hit-or-miss principles are generally followed. One cardinal point must be remembered in all carbureter adjusting, however, before anything else is considered and that is that a leanness of mixture should at all times be favored.

There should be three distinct points of adjustment: First, with the motor idling. That is, with the gears in neutral, the spark retarded and the throttle closed as far as possible. Second, at high speed with gears in neutral and spark advanced, and, third, accelerating on the road. The carbureter should function well under all these conditions and should not choke up or backfire when the throttle is opened and closed rapidly.

Start the motor going without changing the carbureter. If it is impossible to start the motor with this adjustment on the carbureter close the needle valve as far as it will go and then open two full turns on the screw that holds it. In general, on a carbureter it would be well to start with what looks like the medium adjustment on all the valves. The valves differ on all the carbureters on the market, and it is only desired to give a general outline of the process of adjustment so that any carbureter may be tuned up by simply carrying out the previously planned system.

When the motor is running, open and close the throttle several times with the spark set in different positions to see if any black smoke is emitted from the exhaust or if backfiring into the exhaust pipe occurs. **If backfires occur, the mixture is too lean and the needle or fuel valve should be opened slightly or the air valve closed.** Where the adjustments are made on the auxiliary air supply the tension on the spring should be loosened slightly so that the valve will open under less suction. If black smoke is exhausted the fuel valve should be closed. In the latter case the mixture was too rich and this is to be avoided carefully if the carbureter is to give the maximum economy. It is quite possible that too rich a mixture is being given without the exhaust of any black smoke and for this reason it is wise to close the fuel valve until the motor starts to backfire. The needle valve is then opened slowly until the backfiring just disappears.

When the motor appears to be running satisfactorily, try it idling as slowly as it will go. When it turns over smoothly, arrange the throttle valve-stop screw on the carbureter so that the throttle cannot be closed any further. This will prevent the motor from choking up and dying if left running at the curb for any length of time. Now speed up the motor and note if backfires occur. If they do, it will be necessary to tighten the air valve slightly. **In any case do not try to change the level of the gasoline in the float chamber for this is arranged at the factory and is in the best possible position for good results.** When the motor runs as well as it should on high speed, try it again on low, making whatever adjustments on the fuel and air valves that are necessary to secure smooth running.

The car is now ready to be taken out on a hill and given the final test. This is the accelerating powers on the hill. Start the car slowly on the hill and then press down on the accelerator pedal and note how it picks up. If the carbureter chokes and the motor hits on one or two cylinders and then starts to fire regularly, or perhaps continues to miss, the trouble is in the design of the carbureter or the mixture is too rich. **The carbureter should not be condemned, however, if it chokes when the pedal is pressed down as far as it will go immediately.** The accelerating should be done more gradually. When the pedal is pressed all the way down before the motor is moving fast enough to take care of the amount of fuel this will cause to be fed to it, the carbureter is almost sure to become choked.

It is very frequently found that the motor will hit on all cylinders at high speed but that at low speed it will miss badly. This is not due to carbureter trouble in a great number of cases, but to the fact that one or more of the sparkplugs have too large a gap between the electrodes.

Foreign Constructions Designs and Practices

The French School of Engineering

American Engineer Analyzes Features of French Designers and Makers—Delahaye Crankshaft Details—Gearbox Bearing Supports—Accessible Combustion Chambers—Well-Made Air Pumps—Gasoline Tank Locations

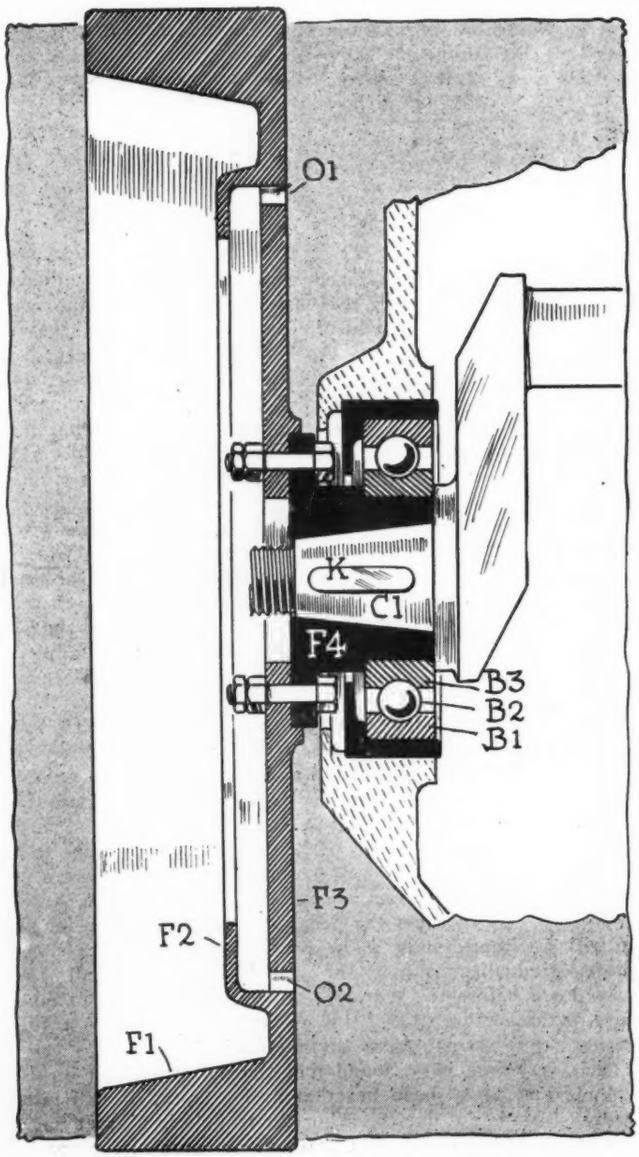


Fig. 1—Delahaye flywheel attachment to crankshaft

IT is in the detail that success or failure lurks. French engineers pride themselves upon their clear understanding of this point. It remains, then, to look at the French method of disposing of details, and learn by so doing how they think and what they accomplish. That there should be a profit in the enterprise must be true. If the French school of designing is far advanced it may be copied with profit. If there are glaring inconsistencies, to unearth them is advantageous; the process will help all around. Then, too, by open discussion, if through some lack of good understanding our appreciation of some of the French methods is to do them an injustice, it will be timely to listen to their explanations to the mutual profit of all parties.

That the French should explain the points that fail to satisfy our understanding must hold so long as French automobiles are offered to our purchasing public. Moreover, we expect to broaden our knowledge of the intricate detail of automobile designing by closely scrutinizing French effort, and it is only fair to them that any little misunderstandings should be wiped out.

With this brief introduction merely to establish the position that we take respecting the subject matter presented here, it remains to introduce the points to be enlarged upon, and for purposes of clearness resort is had to a series of sketches showing as closely as possible how French engineers do their work.

Attaching the Flywheel

Fig. 1 is a section of the crankshaft of a motor at the flywheel end, the flywheel and the crankshaft ball-bearing, showing the method used in assembling as it is brought out in the Delehaye motor of the type offered for use in the postal chassis. The flywheel F1 is of relatively larger diameter with more than the usual amount of metal in the rim. Means are provided for disposing of any lubricating oil which may fall on the flywheel. The flange F2, on account of centrifugal force, forces the oil in the diametral direction and, as it sweeps into the pocket formed by the flange facing the flange proper F3, it accumulates until a sufficient excess is stored, when this excess flows out through holes O1, O2, etc., drilled in the flange F3. The flange F3 is not dished. Since internal strains due to unequal cooling are set up in all castings during the foundry process, and, in view of the absence of any dishing to permit of strain compensation, it must be taken as true that the strains, such as they are, will reside in these flywheels so made, after the automobiles are delivered to users. It would appear, under the circumstances, that French foundry practice must be so

perfected that, by a system of uncovering the metal, which requires precision of workmanship, the metal is cooled fast or slowly over the several zones in proportion to the ratio of surface to mass, sufficiently to save undue internal strains; otherwise flywheels so made must be regarded as bordering upon the unsafe.

The flywheel flange is bolted to a separate hub-flange F4, the latter being on a taper of the crankshaft end C1, and a key K is provided as a further means for preventing rotation of the flywheel on the shaft. It is obvious that the designer is a firm believer in flange-bolted fastenings for flywheels on crankshafts. The effect of this construction is contrary to the designer's express preference. The fastening, taking it as a whole, is that of a taper fit. It is easily seen why the benefit of a flanged fit is lost. The crankshaft is of the ball-bearing type, and in order to locate the ball-bearing it was found necessary to interpose the separate hub with its integral flange F4, and Fig. 1 shows how the inner rod B3 of the ball-bearing is clamped between the shoulders of the hub F4 and the crankshaft C1.

Method Aids in Assembly

The advantage of this method of assembling is one that the salesman can readily appreciate. After the motor is assembled and put in the chassis the casual observer will only be able to see that the flywheel is flanged and bolted to its mate-flange on the crankshaft; but there will be no way of telling that the flange F4 is separate and that, after all, everything depends upon a taper fit of the hub on the shaft end.

Referring now to the ball-bearing, it is true of this construction that it is of large diameter, and service conditions exact just this large diameter of ball-bearing. It is also true in service, as experience has adequately shown, that the inner race B3 of the ball-bearing must be clamped so tight that rotation of the race on its fit will be prevented. The design, however, makes no suitable provision for clamping because it is impossible, in practice, to make a taper fit that will be at once a tight fit and at the same time permit of a fixed travel of the hub on the shaft. If the hub fetches up on the taper of the shaft before it does against the shoulder on the hub clamps the inner race B3 of the ball-bearing, the latter will be free to thrash around, which it will not do for long without showing depreciation; but if the shoulder on the hub F4 fetches up against the inner race B3 of the ball-bearing this is a guarantee that the fit of the taper will be poor, if indeed, it may not be so bad that the key K will be left to do all of the work.

The outside raceway B1 is provided with a jacket of steel, the latter being a tight fit in the base of the aluminum crankcase. If the outer raceway B1 is a tight fit in its jacket of steel, then the axle alignment of the inner raceway B3 with the outer raceway B1 may be such that the balls B2 may be pinched, or the orbit of the balls formed by the two races may be elliptic—the result will take the form of damaged balls. On the other hand, if the outer raceway B1 is a sucking fit in the jacket, then, as experience tells, the race race will pound around in the jacket until some serious mishap sends the motor to the repair shop.

Good Engineering Indications

It will appear from what has been said that the designer in this example picked out a particularly difficult task for his day's work. It would be doing scant justice in this instance not to mention the excellence of proportioning, the eye to exactness, and the generally good completion of the whole undertaking. If there are questions to be answered they have to do with the scheme of design, the principles involved and the expediency of plan involved.

In order to gain further knowledge of French practice, Fig. 2, showing a part of a gearbox in section, is shown. This illustration raises two important questions: First, referring to silence or the reverse, noise; and, second, uniformity of design or, in its absence, there is the expedience of special grades of materials.

The design shows the shaft S1 in its relation to the stubshaft S2 with a ball-bearing intervening in the usual way, the latter being housed in one of a pair of connecting gears. The stubshaft is provided with a pair of ball-bearings B2 and B3, and they are far enough apart to assure a good result. The stubshaft S2 has four diameters, the largest diameter being in the ball-bearing B2, reducing to the diameter of the pore of the pinion P1 of the constant mesh or master gearset, which imparts rotation to the layshaft S3; then the stubshaft S2 is reduced in diameter to facilitate assembling and to accommodate the ball-bearing B3, and this shaft is again reduced in diameter to fit the universal joint member J1.

The plan of construction necessitates these reductions in diameter of the shaft S2, it being necessary to provide for the inner races of the ball-bearings among other points. It must be obvious to the reader that there is a striking lack of uniformity in the strength of the shaft in its relating sections. This defect is all the more significant if the mind reverts for a moment to the fact that the strength of a round solid section changes as the cube of the diameter.

Then there are three abrupt changes in the diameter of the shaft, and as a result, as many shoulders to serve as starting points for cracks, and these cracks are all the more likely to be experienced since the shaft has to undergo heat treatment, the latter being necessary to insure service of the clashing gear on the end of the shaft. True, the designer had no alternative in this case. To get away from the char-

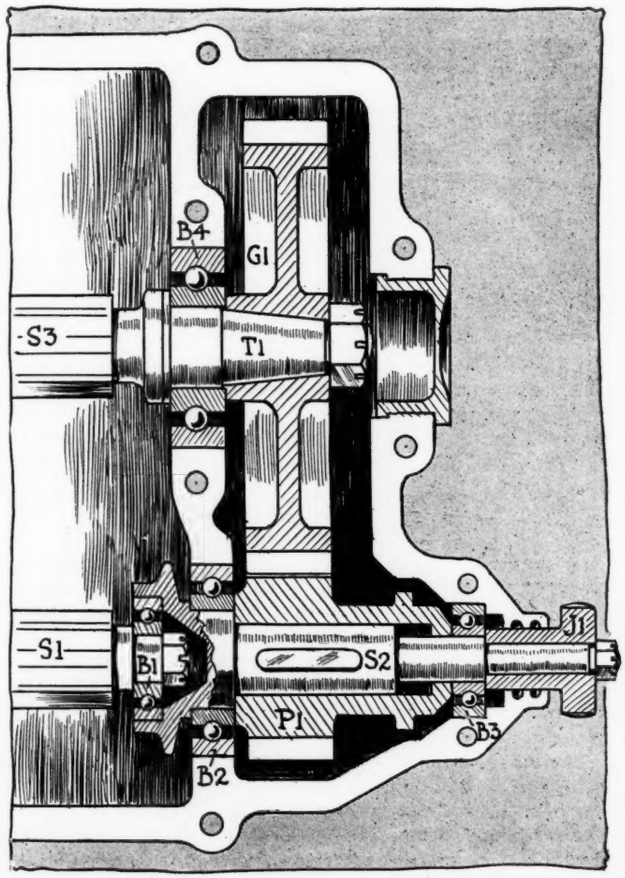


Fig. 2—Part section of Delahaye transmission gear, showing how the shafts rotate, details of design and fitting of relating members

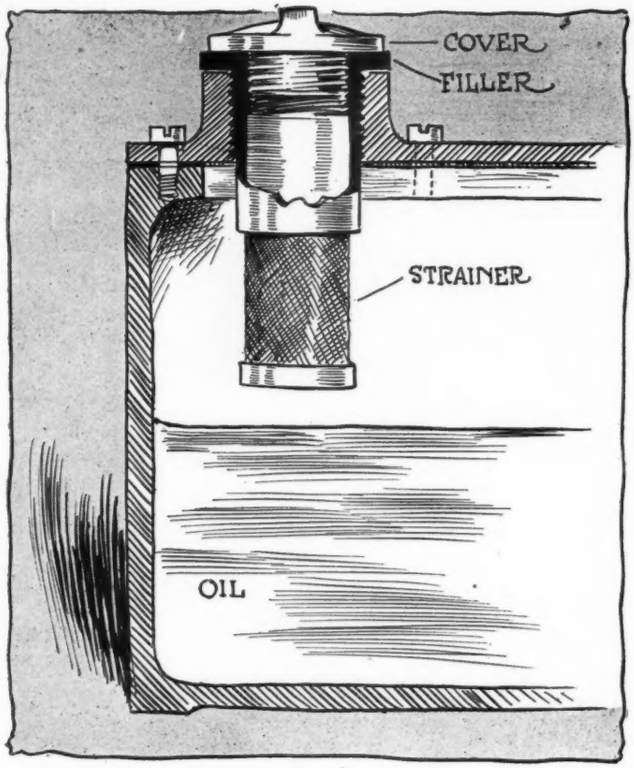


Fig. 3—Oil reservoir of Vermont motor, showing filters for the oil

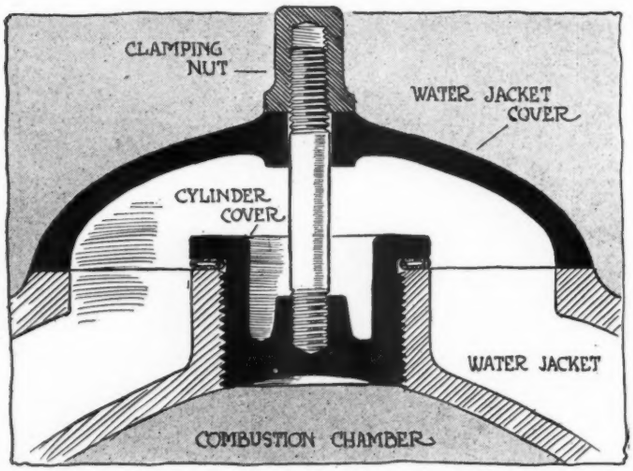


Fig. 4—Securing cylinder-head plug in Cottin & Desgouttes motor in 16-horsepower chassis

acteristics here brought it would be necessary for him to make a new start along more promising lines.

Referring to the important subject of silence, this condition must be difficult to fix in the type of gearset here illustrated, because the gear G1, on the layshaft S3, is pressed up on the tapered end T1 of the shaft, which overhangs the ball-bearing B4; the shaft, in consequence, is unsupported in the plane of the master gear.

There are certain details which receive excellent attention from this illustration, namely, the designer shows by the use of a taper T1 for the gear G1, on the shaft S3, that he has a liking for tapers. The question is, why does he so willingly give up the taper idea when he applies his skill elsewhere, as in the fitting of the pinion P1 on the stubshaft S2; and, too, in the fitting of the universal joint member J1 on the end of the same shaft? On the other hand, why

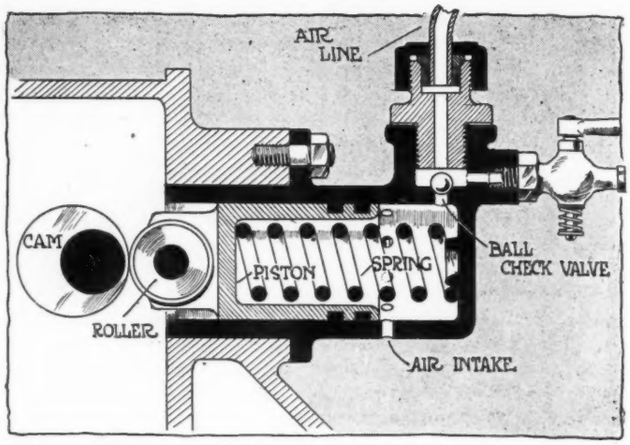


Fig. 5—Air pump in Panhard, showing the piston actuated by a cam and a spring for returning the piston

bother with a taper on the relatively unimportant end of the shaft S3, if a taper cannot be used for the universal joint member?

There are certain details which receive excellent attention in the French school. Fig. 3 will suffice for the moment to make the point. In this illustration the lubricating oil for a motor is shown in a sectional reservoir, partly broken away, and the filler is provided with a filter or strainer, so designed that the strainer may be screwed out, cleaned and put back into place ready for further service in a moment. The oil is put into the reservoir by unscrewing the cover on the exterior of the strainer shell to afford the desired opening and fine mesh gauze is wrapped around the exterior of the shell to serve as a filter. The oil goes into the shell, and, to get to the main body below, it must pass through the gauze. Any dirt is left behind in the shell.

Points in Cylinder Castings

There are certain details which receive excellent attention which are never above suspicion. Take cylinders, for illustration. The practice is to cast the cylinders with a core-hole in the head, it being desirable, if not actually necessary, to fix the core to keep it from displacing by means of a tapered core connection passing through the head of the cylinder, hence the necessity of hole in the cylinder head. **If a hole must be allowed for, the further reasoning is, why not make it large enough in diameter to accommodate the boring for which it is used in the process of rough-boring the cylinders during the finishing interval?**

But the hole in the head is, unfortunately, an opening in the cylinder wall just at the zone of greatest pressure and maximum heat-change, as well as highest temperature, the latter, in internal combustion motors, following as a matter of course. If the cover is not tightly fitted, or if it will not remain tight under service conditions, compressed liquid will escape during the compression and power cycles, and water will enter during the suction cycle. Either of these incidents will suffice to thwart the operation of the motor.

Leakage, due to defective cylinder-head plugs, is still a common trouble of motors, even after 20 years of practice, and French engineers, recognizing this fact, are still on the hunt for something more secure than either of the ordinary methods in vogue. Fig. 4 presents, in section, a cylinder of a Cottin and Desgouttes motor, showing how this firm of the French school approaches the subject. The cylinder-head cover, Fig. 4, is screwed into the cylinder. The water-jacket is provided with a separate cover. A stud is screwed into the cylinder-head cover and a clamping nut on the other end of the stud is screwed down against the waterjacket cover. The adjustment when made presses the waterjacket

cover more or less firmly into place. But all of the pressure exerted by means of the clamping nut on the stud is offset by an equal and opposite force which tends to pull the head out of the cylinder. This pressure is in the same direction as the pressure exerted in the cylinder by the liquid when it is compressed, ignited and burned. These efforts combined tend to strip the threads of the cylinder-head cover and the mating threads of the hole in the cylinder head.

Good Airpump Design

It is not without profit that some of the French cars are examined. They conceal jewels of designing. Fig. 5, a Panhard airpump, shows one of these nuggets! This pump, shown in section, comprises a piston in a cylinder actuated by a circular cam eccentric to the camshaft of which it is a part. The roller, concentric with its pin, the latter passing through a pair of ears extending out from the piston head, is pressed against the cam by spring pressure from a stout spring located within the piston, bearing against the head of the piston at one end of the spring; the other end pressing against the head of the cylinder, the piston is inverted. Air enters through holes in the cylinder wall uncovered by the piston when the same is at the inner end of the stroke as shown. The air is compressed when the cam rotates, pressing the piston out against the spring. The ball check valve is lifted off of its seat by the compressed air which passes on through the air line to the gas line tank. The piston is packed tight enough to hold pressure up to the requirement. The pump is small, with simple construction features, and, in operation, is noiseless. **The advantage of clean air over foul liquid of combustion from the cylinders of the motor for use in the gas line tank is obvious.**

Panhard Clutch Coupling

An excellent piece of designing at a point where strength is necessary is shown in Fig. 6, a Panhard 18-horsepower gearset, showing, in section, the shaft detail as it extends forward to the flanged joint. Attention is called to the bell-shaped flange F1, integral with the fluted extension or hole H1, mating with flutings of the shaft S1, with a nut N1 of the castellated type on the end of the shaft, by means of which the flanged hub is forced against the shoulder S2 of the shaft S1, with an accommodation piece A1 intervening. The second function of the accommodation piece A1 is in conjunction with the thrust ball bearing B1, spacing it in its relation to the annular type ball bearing B2 and the relating mechanisms of the clutch, which, in this example, is placed within the same housing—the clutch is of the multiple-disk type.

But the point which it is proposed to bring out here lies in the excellence of the flanged connection and the generally uniform proportions of the parts. The flange, considering the use of an extension member reaching to a mating flange of the shaft extending back from the motor, affords ready means of removing either the motor or the gearbox unit from the chassis without disturbing the remaining unit.

Dash Gasoline Tank

The desire to place the gasoline tank in the space made by the overhang of the dash is strong. Not a few examples of this idea are bad. Fig. 7, of the tank, as it is located in one of the Delahaye models, corrects the trouble usually experienced. The tank is situated on the side opposite the driver. The pipe, as shown, has a goose-neck bend in it, which saves the pipe from the ills of vibration.

Where to put baggage, or how to do without it, is still on the list of pressing problems to be solved. Fig. 8 is a rough approximation of one man's methods. He was sitting on a mile-stone which indicated that it was 14½ kilometers to Paris when interviewed. The car was considerably encumbered as illustrated. The tourist, a well-known American, said, "I would be all right if I didn't have so damn much tire trouble." The ladies in the party voiced the same sentiment with their eyes.

(To be continued.)

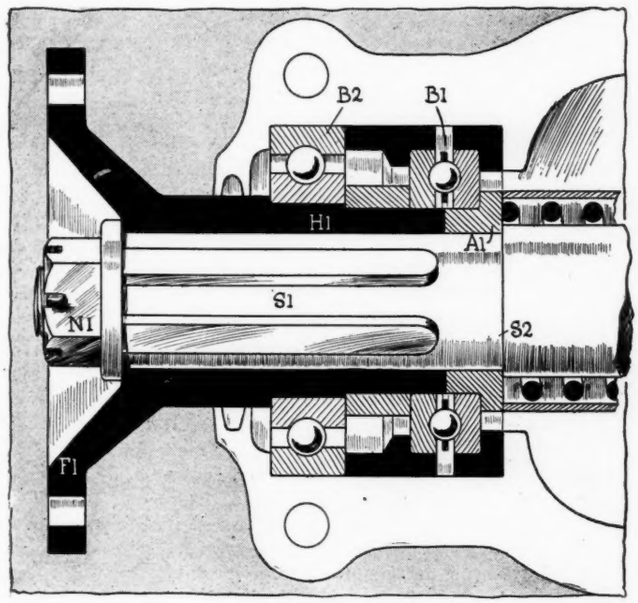


Fig. 6—Flanged coupling of gearset shaft in 18-horsepower Panhard. The motor or clutch shaft carries a similar corresponding flange

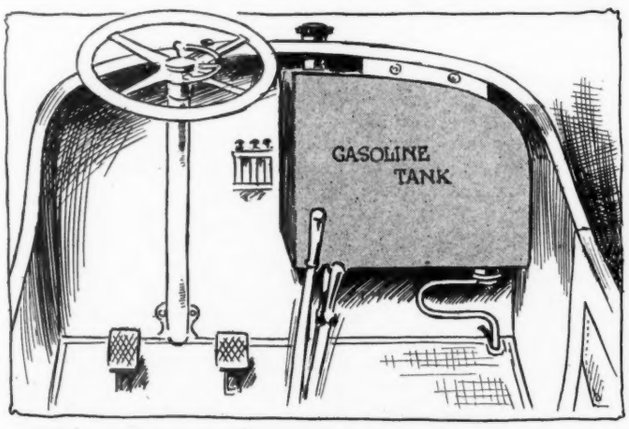


Fig. 7—A neat method of mounting a gasoline tank under the cowl or overhang of the dash

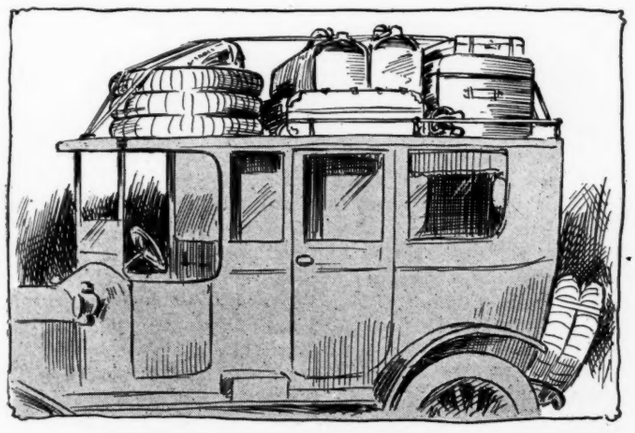
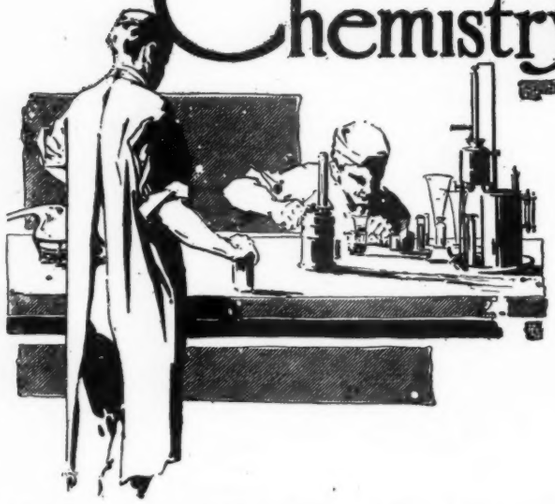


Fig. 8—Illustrating the tourist's limousine that did not have sufficient baggage space

The Chemistry of Cylinder Oils



Nomenclature Not Borne Out by Analysis in Heavy, Light and Medium Oils of the Same Make and Brand

Part V

Being the fifth of a series of articles on cylinder oils which will appear from week to week. Discussions are invited and the columns of THE AUTOMOBILE *are open to pertinent criticisms.*

By W. Jones

IN this article we give the analysis of 28 samples of oil. These samples were all obtained in Detroit, and, with the exception of the last three, or brand N, are supposed to be the same oils as those published last week. They come to us under the same name and grade. While the brands are all represented, the different grades are not all present. This is on account of it being extremely difficult to obtain samples of oil from dealers, for analysis. Just why this objection should exist, we do not understand, except that the oils being handled are not what they are represented to be. That this may be the case seems highly probable, and this view is well borne out when we compare the Detroit samples with the New York samples, or we may even say when we look over the table of Detroit analysis.

We will first make a little comparison between the two tables. In table B which appeared in the November 21 issue of THE AUTOMOBILE, and which shows the New York oils, we have in brand A, eight samples or grades, and these same eight grades are shown in table C, which gives the oil as obtained in Detroit. The gravities in these two lots of oils are fairly well alike, and we think as close as might be expected in commercial samples. When we come to the viscosities at 80 degrees Fahrenheit, more difference is shown; the two white oils being considerably thicker in table B than in table C. Coming to Nos. 1, 2 and 3, we find the reverse; table B being made up of thinner oils than table C. **But when we come to No. 6, the extra-heavy oil, we have a difference which is so great that we can hardly think it is the same oil, or anything like it.** This is also shown in the flash and fire points. However, taking this brand as a whole, with the exception of this last sample, these oils agree fairly well.

In brand B, there is only one grade of this oil put up. This oil is well represented as we have two samples from each city, but it is strange that in New York the oil is heavier than in Detroit, although the first sample is about the same as the second one in Detroit. In this brand, the first sample on the New York table is a sample direct from the works, and we therefore consider this the correct oil. This agrees with the second sample from Detroit. The other two are simply mixed oils and not this oil at all, one being lighter and the other heavier. Considering the parties who put these oils up, we think there is but little doubt that it can be obtained of the same quality all the time, or very nearly so.

In brand C, we have Nos. 1, 2 and 3, or light, medium and heavy, in duplicate from New York, and the same three grades from Detroit. The first three in the New York table are from the parties who put up the oils. The others are not. The second three New York oils are heavier, while of the three Detroit oils Nos. 1 and 3 are simply absurd imitations.

In brand D there is only one grade put up. The sample in the New York table is from the makers, and although a little thinner than that from Detroit, the two agree very well.

In brand E we have in table B Nos. 1, 2 and 3, and in table C only Nos. 1 and 2. The makers of this brand of oil in New York refused to give any samples for analysis. The samples, however, were obtained, with their labels (the labels of the makers) and as far as we could see came from their works. These are shown in the New York samples. **In these samples light, medium and heavy do not seem to mean much of anything, as the medium seems to be lighter than the light. Turning to the Detroit table, we find both No. 1 and No. 2 to be absolutely the same oil, which does not agree very well with any of the New York grades.**

In brand F, we have in table B three samples Nos. 1 and 2; No. 2 being in duplicate. They are supposed to be the same oil, with the exception that the second No. 2 has had an acid treatment, while the first has not. This acid was found in the oil, as it seems that it can never be wholly removed. The analysis of these two samples show them to be practicaliy the same oil in all respects, but when we turn to the Detroit sample, there does not appear to be the least resemblance, except in the gravity, and we do not think it would take much stretch of the imagination to say that this oil is the same as the last two, or brand E in the Detroit oils.

In brand G, we have for comparison Nos. 1 and 2. In both cases, both New York and Detroit, the oils come through dealers, so there can be no certainty as to what we have. However, the three New York oils seem to run fairly well from light to heavy, and would appear to agree very well with the three grades in other brands. Turning to the Detroit table, we have Nos. 1 and 2, but do not find the least resemblance to the New York samples, while in No. 1 we again have the same oil as in the last two brands, No. 2 being a very different oil, as is shown by the gravity and the viscosity, and also by the fact that it does not contain any sulphuric acid, while all the others do.

In brand H we find three samples from the oil company in the New York table, and only No. 2 from the Detroit company. These two No. 2 samples we find to vary all the way through, and also find that the three New York oils have had no acid treatment, while those from Detroit have had it,

and again we do not hesitate to say that this is the same oil that we have had in E, F and G.

In brand I, we have three samples on the New York table, which came from the oil company. **The viscosity in these samples show a wider variation than in any other oils we have had.** In the No. 3, or what is marked heavy oil, the viscosity is 54.6428, and in these three oils No. 1 has had acid treatment and contains sulphuric acid, while Nos. 2 and 3 have not been so treated. Now, when we compare this No. 3 oil with the No. 3 we have in the Detroit table, we find a viscosity of only 4.8214. This, at first sight we thought might be a mistake in the marking of the oil before being sent; but it does not agree even with No. 1, except in gravity.

In brand J, we are again not sure of our samples. The New York samples came through a large dealer, but were not original samples. Therefore there is doubt as to their being true samples. The two New York samples are very much alike, partcularly as to viscosity. The two from Detroit are also very much alike, but differ very much from New York, both in gravity and viscosity. Neither of the two New York samples contain sulphuric acid, while both samples from Detroit are full of it.

In brand K, we have only one oil for comparison, No. 2. These oils are very different, not only in gravity and viscosity, but also in that the New York oil does not show sulphuric acid, while the sample from Detroit does.

In the Detroit oils if we compare the brands I, J and K together, and note the fact that they contain about the same amount of sulphuric acid, it would look as though they were practically the same oils, and we will further say that we think they are **the same oils that we had in E, F and H, only mixed with a little lighter oil.**

Brand L, contains only one grade, and we have the same grade from both New York and Detroit, but as neither are original samples, again, we are not sure of them, although the New York sample came through a large dealer and we think is all right, and as we come to the bottom of the list, it is somewhat of a relief to have two samples from the two cities, which are very nearly alike, and without acid.

We notice two points in these two lots of oils. First, the carbon figures in the Detroit oils as a whole are lower than those we had in New York. This would seem to be largely due to the oils from brand E to K being practically the same oil, and an oil giving a low carbon.

The second point, which is due to the same cause, is the large number of Detroit oils which have sulphuric acid in them. We have in the twenty-eight samples fourteen which have the acid, while in the New York samples there are only eight out of forty samples carrying the acid, and in four of these there are only traces. This acid, of course, has been added in the treatment of the oil, and it seems that after this acid treatment, it is not possible to remove the acid entirely, by washing. This small amount of sulphuric acid does not appear to be any more harmful than to slightly corrode the cylinder, and this corrosion is not very heavy, but its presence is an easy means of deciding between an acid and non-acid treated oil, and if we are expecting to get a certain oil which we know is a non-acid oil and get one containing acid, we are certain we are not getting the oil we expected. It makes no difference if the dealer considers the oil just as good or even better. When a certain make of oil is called for, that is what we should get. That this is not always the case, may be shown in the following.

In the New York oils we have the acid, present only in the eight cases shown in the table, while in the Detroit oils we have it in many more oils which are supposed to be the same. The brands of oils in the New York table which show this acid also show it in the Detroit table, and in addition to these, the Detroit oils show it in the following brands where the New York table does not.

Brand A, No. 2; brand C, Nos. 1 and 3; brand E, No. 1; brand F, No. 2; brand G, No. 1; brand H, No. 2; brand I, No. 1; brand J, No. 1, and brand K, No. 2.

Here we have a list of ten oils, which by this one test alone cannot be the same oils as those obtained in New York under the same names. Therefore, unless you are dealing with a reliable party, it is useless to think you are getting what you want, or what you are paying for, and, as in the case of the Detroit oils, where without doubt many of the oils came out of the same lot or barrel, you may be getting the same oil you want as far as the label is concerned, and no more.

(To be continued.)

TABLE C—ANALYSES OF AUTOMOBILE CYLINDER OILS—BY. W. JONES

Brand A	Specific Gravity	Specific Viscosity at 80° F.	Specific Viscosity at 212° F.	Specific Viscosity at 350° F.	Carbon per cent	Flash Point °F	Fire Point °F
No. 1a	0.8650	3.5714	1.2500	1.0714	0.37	434	478
" 2a	0.8838	3.2143	1.2143	1.0535	0.36	404	448
" 1	0.8993	3.5714	1.3214	1.0892	0.31	388	452
" 2	0.9034	4.8214	1.3571	1.0357	0.58	406	468
" 3	0.8992	7.5000	1.3928	1.0535	0.75	422	474
" 4	0.8995	4.5714	1.3571	1.0535	0.52	410	470
" 5	0.9098	4.9642	1.2875	1.0535	0.75	406	458
" 6	0.8837	22.1430	2.0357	1.1250	1.05	478	536
Brand B.							
No. 2	0.8985	3.5714	1.2857	.....	0.95	408	454
" 2	0.9003	4.6785	1.3571	1.0357	0.80	406	456
Brand C.							
No. 1	0.8765	8.5000	1.3928	1.0535	0.76	432	488
" 2	0.8689	3.7143	1.2857	1.0535	0.40	434	494
" 3	0.8797	11.8571	1.5714	1.1250	0.94	460	518
Brand D.							
No. 1	0.8727	4.7857	1.3571	1.0714	0.51	436	510
Brand E.							
No. 1	0.8762	5.8928	1.3928	1.0714	0.45	434	508
" 2	0.8768	5.8928	1.3928	1.0714	0.45	442	594
Brand F.							
No. 2	0.8760	5.8571	1.3928	1.0714	0.42	448	510
Brand G.							
No. 1	0.8765	5.7142	1.3571	1.0714	0.48	446	506
" 2	0.8856	6.2500	1.4285	1.0714	0.39	452	518
Brand H.							
No. 2	0.8768	5.8928	1.3928	1.0714	0.32	442	506
Brand I.							
No. 3	0.8765	4.8214	1.3928	1.0714	0.32	442	506
Brand J.							
No. 1	0.8765	4.6857	1.3928	1.0535	0.30	442	500
" 2	0.8763	4.6785	1.3571	1.0714	0.42	440	506
Brand K.							
No. 2	0.8768	4.9285	1.3214	1.0714	0.33	442	508
Brand L.							
No. 1	0.8706	3.0000	1.2500	1.0535	0.40	410	460
Brand N.							
No. 2a	0.8669	4.6428	1.3750	1.0714	0.25	444	504
" 3a	0.8699	9.2857	1.5892	1.1071	0.30	456	516
" 2	0.8766	5.2143	1.3392	1.0714	0.50	440	502

The Joining of Metals

A Description of the Three Groups of Processes, by Means of Which Metal Parts May Be United

Ordinary Cementing, Autogenous Fusing and Cementing Under Pressure Are Applied in Different Instances

Extract from a paper read before the British Institute of Metals by Alexander E. Tucker, F. I. C.

THE methods in practical use for joining metals may be divided in the order of their importance as follows:

1. **By metallic cements,** such as tinman's or brazing solder, which have to be brought to the plastic or liquid state, and whose constituents should be capable of alloying perfectly with the metals to be joined.

2. **By autogenous fusing,** in which the two parts are heated and liquid metal of the same character run around the mass, or the parts are heated to fusing point, and the surfaces worked together by pressure or hammering.

3. **By the use of a cementing metal under pressure,** generally that of a rolling-mill, and at ordinary or only slightly raised temperatures.

In respect to the first method, it is obvious that the fusion point of the solder must be lower than that of the articles to be joined, and as, speaking generally, the higher the melting point the stronger the solder, it follows that **it is desirable that a solder or brazing spelter should be used whenever possible, the melting point of which is only a few degrees less than that of the metals to be joined. The solder should also have, if possible, the same characteristics, such as malleability, color and hardness.** Such conditions imply greater skill on the part of the operator, but the union will be the more perfect, and the process under such conditions more nearly approaches autogenous soldering.

Tinman's Solder—Field and Use

Tinman's Solder—In the use of this care should be especially taken to avoid the presence of zinc, and in certain cases even a trace of zinc is especially prejudicial; it thickens the solder, and probably on account of its liability to oxidation forms a superficial scum which the ordinary spirits of salt is incapable of dissolving. If the presence of zinc be suspected, the addition of a few drops of acid will help greatly. Antimony is frequently present in tinman's solder—this, by forming a cement of higher tensile strength, may, under special conditions, make a joint of greater strength. **In the use of solder—either soft solder or brazing solder—it is clearly the correct method to raise the work to the highest temperature that the solder and the work will stand, because under such conditions the penetration of the solder into the surfaces to be joined will be better, and further, the soldering medium may then be squeezed out to the maximum from between the surfaces by suitable means, and hence the requirement can be met, that the thinner the layer of cementing material and the closer the surfaces are together, the stronger the join. Additional strength, because of the additional intimacy effected, may be given to the work by rubbing the surfaces carrying the liquid solder together;** in the same way it is always well to rub the soldering iron, when possible, over the work when it is used, the wetting of the surfaces is then more perfect, and no stripping of the solder is possible when this rubbing is done. In order to obtain a lower melting point in tin solder, bismuth, and sometimes cadmium, is added. Such solders are used for delicate work, as is occasionally required for electrical fittings.

Bicycles have been built in which the tubing was fixed in the respective lugs with soft solder instead of the ordinary brazing. They stood every test.

The conditions here are very different from those in the case of the brazing of brass and copper, because it happens that all the metals employed in brazing and tinman's solders destroy the character of the steel they are intended to join if they are heated sufficiently with the steel, while they have no corresponding injurious effect when used for brass or copper work.

When soft solder is used the thin gauge tubing is not so likely to be spoiled by deteriorating action on the steel, or by being oxidized at the heat necessary for brazing; and, further, on account of the greater liquidity of the soft solder, it will, when properly applied, sink into the small annular space between the lugs, etc., and the tubes more completely than can be expected with the more viscous flux and brazing solder. The reasons that soft solder is not used for such work are, firstly, because the heat of the enameling stoves makes its use risky, and secondly, popular prejudice—a soft soldering frame sounding badly to the untechnical layman.

It is a common habit of workmen, and amateurs who have soft soldering to do, to depend on the ordinary bit, when they might **use a Bunsen or blowpipe. These, in many cases, would heat the work more generally than is possible with the bit, and would allow of the penetration of the solder into the surfaces, and the subsequent squeezing out of the excess of solder.**

On the other hand, many forms of soldering bits are now in use, in which a Bunsen burner connected with a light flexible tube is employed to heat the bit, and the flame can be conveniently made to heat the work as well. This form of soldering iron has many advantages. One of the best fluxes I have found for ordinary soldering can be easily made by macerating flux skimmings from galvanizing pots with weak hydrochloric acid. On filtering, the solution is ready for use, and is an ideal flux, because of the chloride of ammonia present with the chloride of zinc. No iron or lead is dissolved if the acid added is not in excess. Solder is often used in the form of granules or strips of various sizes, and in this form is very convenient for routine work. In the case of spectacle frames or other light articles a large amount of work can be prepared, on each of which a small piece of solder, either in the form of a granule or a strip, is placed with flux on the part to be joined. The articles are then put in a tray, which is afterward taken to a muffle working at a convenient heat, or in some cases it is sufficient to put the work on a metal plate, heated by a gas flame or even a spirit lamp. Brass tubes are often made by bending the strip through dies and fixing a wire of suitable composition in the overlap with borax, or the borax may be mixed with finely granulated spelter. On passing the work through a furnace to raise it to a red heat, the spelter runs perfectly and a good join is made. The flux is then dissolved off the work and the tubes are finished by drawing through dies with or without a mandrel.

The best brazing, if it may be properly so termed, is done with "silver solder," thus the blading used in turbines is all fixed with silver solder. It is, of course, of the utmost importance that the small pieces used in the construction of turbine motors shall be immovably fixed and cemented in position, on account of the heat and centrifugal strain to which they are subjected. Various silver alloys are used, but they are generally about 60 of silver, 23 of copper and 17 of zinc, the flux used being borax, or borax and carbonate of soda. Such a mixture is remarkably liquid when in the molten state, and on this account penetrates interstices which ordinary brazing spelter would fail to fill.

Composition of Brazing Solder

Brazing Solder—**The composition of ordinary brazing solder ranges** within wide limits; the analyses of samples I have examined show a variation **from 61 to 33 per cent. of copper and 39 to 67 per cent. of zinc. The tin may vary from nil to 14 per cent. and the lead from nil to as much as 3 per cent. Any of such metals may be and are used for brazing, in accordance with the character and requirements of the work to be done. The higher the percentage of copper the higher the melting point, and the higher the percentage of tin the lighter the color.** We thus have a very large series of alloys available for very varied requirements. The presence of other metals when in small amounts is often of no consequence in the brazing of brass or copper, though obviously in all cases it is very desirable in important work, such as the brazing of high-pressure steam-pipes or where great strength is required, that the composition of the brazing metal shall approach as closely as possible to that of the metal to be joined, as only under such conditions can the maximum strength of the joint be obtained, and it is the non-observance of these conditions which has led to disaster. The skill of the workman is often limited to the fluxing of the solder, and seldom extends to an appreciation of its composition.

When, however, we come to brazing iron and steel the importance of purity is very much greater, and I have found the presence of tin in brazing solder intended for bicycle frames to be very injurious. The explanation is probably to be found in the extraordinary deleterious effect of tin on iron and steel. It is well known that a very small amount of tin scrap, if allowed to get into a bath of molten steel, will make it very red short, and when brazing solder containing as little as 0.5 per cent. of tin is used for brazing bicycle

frames I have found that the joints are very unsatisfactory and unsafe.

An ingenious method of making a brazed joint is by connecting the two parts to be joined with the terminals of a suitable dynamo. On account of the local resistance the two parts become heated, and if suitable brass wire is wrapped round the object and the whole surrounded with a reducing gas, such as hydrogen or coal gas, a very perfect joint is obtained without any borax or other fluxing medium.

The reducing gas under such conditions will ensure the absence of any oxide of iron or other metal used, and no previous cleaning is required. Such method of joining has the great advantage that there is no borax to remove from the joint. On account of its great hardness this removal of borax is a serious matter, and much money has been spent on experiments to remove it by pickling and other methods. It is best removed by sand-blasting, the whole frame being so treated leaving an excellent surface, on account of its roughness, for enameling.

Liquid Brazing—Several patents have been taken out for details of apparatus in which a bath of brazing spelter has been kept liquid. The parts to be joined are dipped in the molten metal, the metal being prevented from adhering to the parts that have not to be brazed by applying a coating of blacking to them. The advantage of this method consists in the fact that less metal is used in making the joint, as so little is lost in applying it, and also the heat is general on the joint instead of being local, and I have no doubt that on routine work the consumption of gas for heating is less than when blow-pipes are used, and, of course, blast is not required.

Brazing by Copper-Wire Pieces

A modification of brazing is the use of copper in the form of sheet or wire. Under the Simpson patents tools are thus made in which the cutting part is a small piece of high speed or other steel, while the shank is mild steel or iron. In making, say, a lathe tool by this process, a bar of square mild steel is taken, and a channel planned or milled out on it in which a suitable square piece of high-speed steel fits. The two or three sides being clean, strips of copper are fitted in with a special flux, and the whole highly heated to the fusing point of the copper. After welding, the compound tool is cleaned up and treated for hardening and tempering in the ordinary way. There are some features about this process of building up tools which seem to have considerable merit. First, if ordinary brazing were used, the hardening of many tools implies such a temperature as would often destroy an ordinary brazed point. The zinc would possibly be volatilized, which is not the case when copper alone is used, the temperature of fusion of the copper being so much higher. Secondly, it is conceivable that the weld would be considerably stronger than with an alloy of zinc, because while copper alloys to a considerable extent with iron, the same cannot be said of zinc, which therefore under such circumstances would become a deteriorating element. Thirdly, the saving of expensive material, such as alloy steel, must be considerable in the case of heavy machine tools, as only a small portion of metal is ever in actual use. In a sense, therefore, the shank becomes a tool-holder without the disadvantages of the latter in respect to unsteadiness, difficulty of setting, etc. The process lends itself to many interesting applications, thus milling cutters may be made having a core of mild steel instead of tool steel. Hardening and tempering such cutters is a source of much difficulty and loss through distortion and cracking, and if the compound cutters can be so produced the possible economy should be considerable. There is no doubt as to the perfection of the join, as I have seen pieces of steel joined by the process which on splitting did not part at the weld, the original metal appearing to be the weaker material.

A process has been invented by F. Pich (Berlin) for the hard brazing of cast iron in a smith's hearth. The patent consists in the decarbonization during brazing of the cast iron surfaces to be united, and in bringing at the same time the molten brass solder into close contact with the cast iron surfaces which are decarburized, but without exposure to the air. For the decarburization of the surfaces copper oxide is used, which is mixed with borax, as a flux, until it has the consistency of a paste. This is applied to the surfaces to be joined, which must first be carefully cleaned. The cast iron pieces are then firmly tied together with wire and heated. The borax first melts, protecting the surfaces from oxidation, and taking up any oxide that may be still clinging to them. It also precludes the attacking of the copper oxide by the oxygen of the air. As the heating proceeds the copper oxide fuses and gives up to the now red-hot surfaces its oxygen, which combines with the graphite of the cast iron forming carbon monoxide and dioxide, while the metallic copper is set free in a very finely divided state. This alloys with the brass solder as it melts when strewn on, and the new alloy combines with the decarburized iron of the surfaces which it is desired to join.

Specimens of cast iron united by this method were prepared and subjected to tensile and breaking tests, and **a summary of all the results shows that when the brazing of cast iron pieces is carefully performed according to the details given by Pich, the strength of the pieces so joined is virtually equal to that of the solid material.**

As is well known numerous patents have been taken out, and numerous mysterious mixtures have been advertised for the so-called soldering of aluminum. In nearly every case the result is that, while fairly satisfactory for a short time, the join failed after a time, varying from a few days to some months. **One of the most severe tests to which such joins in aluminum can be subjected is that of warm steam. Joins which look well and are apparently mechanically strong, fail rapidly when submitted to this test.** In all soldering, it is obvious that the flux used must efficiently clean the surfaces of the metals to be joined, otherwise no alloying of the solder used with the surfaces is possible. In the case of aluminum very few materials adapted for such fluxes are available, the requirement being that they shall absorb oxide of aluminum. Another detail of importance is the great heat conducting power of the metal. A consideration of the results obtained with all the so-called solders of aluminum shows that the metal is so susceptible to electrical action and oxidation that the use of any metal in which aluminum itself does not preponderate is hopeless. The best results have invariably been obtained when the solder was of the same composition as the material to be joined. This condition involves the principle of autogenous soldering, which will be subsequently dealt with. The best flux used is a mixture of alkaline aluminum chloride, with the addition of fluorides, such as potassium fluoride or calcium fluoride. When these are mixed in suitable proportions and damped with alcohol, and heated on a strip of aluminum, the surface of the metal is cleaned perfectly. It therefore follows that if two surfaces of aluminum are so cleaned, and an alloy containing a high percentage of aluminum, with such addition of other melted metal as will reduce its melting point slightly below that of pure aluminum, applied with the flux named, that a very satisfactory join will be obtained. The heat such as from a spirit-lamp or Bunsen burner must, however, be applied from below the work. I have seen such joins made over a spirit-lamp which stood every test, including that of the steam test.

Difficulties arise from the presence of high percentages of aluminum in alloys in connection with soft soldering. These may be largely overcome by coating them electrically with copper. The following directions for soft soldering their alloys, containing from 5 to 10 per cent. of aluminum, have been issued by an electric smelting company:

"Cleanse well from dirt and grease. Then place the part to be soldered in a strong solution of sulphate of copper, and place in the bath a rod of soft iron, touching the parts to be joined. After a while a copper-like surface will be seen on the metal; remove it from the bath, rinse quite clean and brighten the surfaces. The surfaces can then be tinned in the ordinary way."

Uniting Lead Joints by Heat

It is obvious that these directions are intended to be used only where an ordinary electrotyping plant is not available.

The second method of joining metals referred to is that of autogenous fusion or running liquid metal of similar character on the surfaces to be joined, and in its simplest form is very old. It is illustrated in the case of repairing broken rolls and in lead-burning. It has been a practice for the broken surfaces of rolls to be cut away to give room for the new metal. The whole roll is then heated and hottest possible metal run into the intervening space, with suitable headers to allow of escaping gases. I have seen very successful jobs made under these circumstances, and the system is obviously applicable to many other cases.

In the wiping of lead joints for water services we have an example of semi-fusion welding, for, as is well known, the metal used, invariably a mixture containing a high percentage of tin—lead 33 and tin 67—is always in the plastic state during the operation. Great skill is shown by the workman who frequently makes his own metal, not only in so adjusting the addition of the tin that he can tell by its appearance whether he is right or wrong, but also in his use of it, because the heat at which he applies it has to be adapted to the work in hand, and judgment must be further exercised in seeing that the successive layers he applies are really

melted or crystallized on to the preceding chilled ones without any "cold shutting." This process of wiping a joint looks very simple, but undoubtedly it requires a great deal of experience and observation for its successful practice, and many branches of plumbing in which the various pieces of lead are joined show a very high order of technical and manipulative skill. On the other hand, I am told by good practical men that if they had their choice there are many cases where they would not wipe the joints. Thus, if a union or cock has to be fixed in a lead pipe, the pipe can be coned or socketed and tinned inside, and if the union or cock to be fixed is also tinned and driven in the pipe, and tinman's solder with extra tin be melted in the annular space with a soldering-iron and finished with a blowpipe, a perfectly satisfactory join results. I think that this is so is obvious, as the bursting strength is clearly greater at such a point than that of the pipe itself. It is also obvious that the bursting strength of most of the wiped joints is unnecessarily greater than that of the pipe on which they are made, and so expensive metal is correspondingly wasted. Two ends of lead pipe may be joined perfectly by fitting one into the other and tinning both surfaces and using solder, as above mentioned. Such joints, however, are not recognized in England by public authorities, though I have often seen them, with variations of detail, on the Continent. Thus I have seen a tinned brass tube inserted in the two ends and the whole soldered up—this makes a very neat and cheap job.

History of Autogenous Fusion

The application of autogenous welding by acetylene hydrogen, benzol, petrol or other hydrocarbon vapor to commercial purposes has extended enormously during the past few years, and constructions and work are now possible by the use of such methods which could not be carried out by any other means, thus repair work of ferrous and non-ferrous metals is now done in every town of importance and tubes of all sizes are made on a very large scale. For branch pipe construction the process is quite unrivaled. For high-pressure steam-pipes the joints after screwing are often welded up, and metal vessels instead of being made with folded joints are now made with the blowpipe more cheaply and far more efficiently. **Lead burning forms an excellent practice for acetylene welding, as it is fusion welding in the simplest form. It is usually carried out with hydrogen and air, and if the workman can make a good joint with and without a stick of lead it is a very easy step for him to advance to making one of aluminum or steel, or any metal.** Lead burning, which at that time seems to have been also known as "autogenous soldering," was first introduced about 1833 by Mr. Mallet, although the invention was also claimed by Professor Daniel, of King's College, and Mr. Thomas Spencer, of Liverpool, read a paper "On the Theory and Practice of Soldering Metals," before the Liverpool Polytechnic Society in 1840, in which he also claimed the discovery of the process. The advantages of such soldering were at once appreciated, especially for chemical works. The objections to ordinary tinman's solder were the great local action set up by varied metals used; and further, the contraction and expansion of the solder under the influence of heat is different to that of the lead which it joins, and so leaks are much more likely to develop.

Fletcher, of Warrington, was the first to introduce autogenous welding. This was in 1888, but he had no commercial success, partly on account of the low heating power of the oxygen and coal gas which he employed, and, secondly, on account of the poor quality of the oxygen at his disposal. Further, the blowpipe used was very imperfect; there was great difficulty in maintaining a uniformly reducing flame. The first practical success with fusion welding was obtained by the late Felix Jottrand, of the Oxyhydric Company of Brussels, who also introduced the first commercially successful application of oxygen for the opposite purpose, namely, the cutting of iron with oxygen, a process also previously demonstrated by Fletcher.

Jottrand's success was undoubtedly due to the fact that the gas employed by him was made by the electrolysis of water, and so was of high quality, and his blowpipe, though complicated, was very efficient. It is still a disputed point whether under some conditions his method with oxyhydrogen is not better than oxyacetylene. In either case it is important that the oxygen used be considerably less than the theoretical amount required, in order that although only a lower flame temperature is available the flame will always be reduced in character. **Benzol, petrol and other hydrocarbons have been recently used in place of hydrogen and acetylene for autogenous welding, and their use would under certain conditions have advantages.**

In practice I have found that a proportion of four volumes of acetylene to five of oxygen gives much better results than the theoretical two volumes of acetylene to five of oxygen. So important is this detail that blowpipes are now generally constructed to consistently maintain a reducing flame. Such a blowpipe is that of the Drager-Greishiem. In this blowpipe the automatic reducing valves on the cylinders are fitted with gauges, which instead of being graduated to pressure are marked with the thickness of the material to be welded—all, therefore, that is necessary is for the workman to adjust the springs on both regulators, so that both gases indicate the same thickness. A simple mechanical mixer is arranged on the blowpipe, making the whole apparatus very practical and convenient.

A characteristic of the oxyacetylene flame is that it indicates the correct mixture, for when the acetylene is in excess a small green cap appears over the inner cone of the flame. On reducing the oxygen there is a point at which the cap disappears. The right mixture is just at this point, and the effect is so distinct that when working with acetylene the workman has no excuse for not getting the right proportion.

If temperature were the only consideration, the oxy-acetylene process would be used in all cases in the working of thin metal, but its use requires much greater skill than the lower heat of the oxy-hydrogen flame. Then again, when a fixed acetylene generator is not available, the risk and danger of a portable generator is considerable, and in such cases for oxy-acetylene welding "dissolved" acetylene only should be used. On the other hand, this is very expensive, and the apparatus is heavy, and it therefore follows that the oxy-hydrogen method with its complete portability is very often to be preferred, because hydrogen can be obtained in the usual bottles, and thus forms very convenient plant.

In welding metals other than iron, not only the melting point but the heat conductivity of the metal must be considered. Thus copper with its high conductivity and its low melting point can hardly be worked with the oxy-hydrogen flame. Indeed, for the same section as iron it requires a much more powerful oxy-acetylene flame. Brass, bronze, and indeed any metal, may be autogenously welded, and many require much less care than that for aluminum.

The conditions of success which apply to all welding with acetylene or other hydrocarbons are: (1) the use of pure gases; (2) the use of a metal rod of approximately the same composition as that of the work to be joined; (3) the thorough fusion of the inside surfaces before the additional metal is applied; (4) cleanliness of the parts, and when desirable the use of suitable dioxidizing and fluxing powders, such as charcoal and borax, and lastly, the use of a blowpipe capable of complete control in respect to size of flame and proportion of mixture. With extended experience in the autogenous joining of non-ferrous metals, it is to be expected that this method will replace ordinary brazing where quality of work is of the first importance.

Welding of Alloy Steel Described

It should be noticed that in consequence of the highly local heating action of acetylene, contraction strains are likely to be set up, which may be more serious than those occasioned when the whole work is heated and welded up in the smith's fire in the ordinary way. In the case of cast iron, it is very desirable that such strains should be avoided by making the weld first and then reheating the mass as much as possible, and cooling slowly. With respect to steel, it has been repeatedly shown that an acetylene or electric weld should not be hammered while the weld is being made. It is well known that cracks are likely to be made by hammering the metal at a black heat, a temperature occurring quite close to the point of fusion. The work, therefore, should be allowed to cool slowly and then raised to a high temperature in the ordinary way and not by the blowpipe; the weld can in this way be much improved both in shape and strength. A good fusion weld very seldom breaks at the point of welding—indicating, therefore, that this point is stronger than the neighboring metal. I believe this is the explanation of the paradoxical effect noticed with fusion welding, that thick sections never give as high a tensile strength as thin. I have figures showing this.

Thus .167 inch 3 per cent. nickel steel strips gave 97 per cent. strength, 1.25 inch gave 90 per cent., while 1 inch bars broke at 60 per cent. to 70 per cent., with the fracture clear of the weld every time. Again, welded .5 inch copper rods drawn down to .375 inch in the ordinary way gave regularly 95 to 97 per cent. as compared with the original drawn rod.

There is an interesting series of processes for the autogenous joining of metals, most of which are patented, which depend on the reducing power of aluminium. **Anyone who has seen the application of the Goldschmidt or**

Thermit process to the joining of the ends of tram-rails can hardly fail to be struck by its extreme beauty and simplicity. We have here a small steel foundry not much larger than a silk hat, from which the metal pours in a perfectly liquid state.

As showing the great heat obtainable when aluminium powder is used for welding, it may be mentioned that if a wrought iron plate 1 inch thick is placed under the crucible, the liquid metal when tapped will burn a hole straight through it, leaving a fairly smooth edge. Experiments show that the heat of the molten metal approaches 3,000 degrees Centigrade, the temperature of a Siemens furnace being about 1,600 degrees Centigrade.

It is very probable that in point of strength most Thermit welds are superior to those electrically made, because the volume of heat is greater if not more intense, and, again, there is less risk of the original surfaces being burnt or oxidized. The Thermit metal can also be adjusted to carry reducing media, which would quite eliminate any oxidizing influences.

A third system of autogenous welding is the electric, of which two methods are in use—namely, arc welding and resistance welding.

Arc welding is applied for repairing breakages and filling up flaws in castings, while resistance welding is rapidly being adopted for the working up of metal articles, and it is common to find electric plant in operation for sheet-iron working. Two forms of machines are on the market for this purpose, one known as the Spot-welding Machine, and another for Butt-welding. In the spot-welding machine the sheets are joined at spots instead of rivets, hence the name. The electrodes are shaped in accordance with the work to be done, and are put onto the work by pressure effected by a foot-lever, and the current, which is automatically switched on at low potential, welds the parts together at that point. After removing the foot-lever the work can be moved along for welding at a new point.

The entire process is so rapid that an unskilled workman is able to make 1,000 welds per hour on plain sheets, while in the same time an experienced hand could hardly put together a quarter as many rivets. The up-and-down movement of the upper electrode may be performed automatically by means of a motor electrically worked. The electrode then falls and rises at regular adjustable intervals, and the workman only has to move the pieces of work.

This machine may also be applied on water-tight welding. In this case the travel of the work takes place slowly, so that the points of welding lie close together, forming an unbroken seam. The edges of the sheets are completely softened, and are pressed together seamlessly. Similarly, when the sheets are not too thick, and irregular shaped sections do not have to be dealt with, the spot-welding machine makes a very satisfactory weld. Thus wheel rims for cycles and motor-cars can be joined perfectly by its means, while the advantage of this system for welding handles on covers, or for welding rings on cooking utensils, etc., are conspicuous. In the same way half-stampings, such as kettle spouts, make up to a very satisfactory job with seamless welding.

Spot-welding is coming into very extensive use for the manufacture of kettles, buckets and similar articles in which the surface is required to be joined only in parts.

In the case of kettles intended for enamelling the old form of riveting occasioned difficulties when the goods were enamelled, because the edges of the rivets and the edges of the sheet refused to take the enamel, or in such thin layers as to interfere with the appearance of the finished work. The difficulty has been avoided and riveting rendered unnecessary by fusing the parts which were formerly riveted by means of the electric arc. The two surfaces are fused together at the point at which the arc is applied, and the enamel can then be run on without any difficulty.

Again, in the manufacture of gas-stoves, where it is desirous to have a layer of air between two sheets in order to economize heat, spaced depressions are made by means of a blunt punch on the sheets, and the sheets put back to back. On applying the arc to the depressions the apices of the latter are fused together, after which the sheet or sheets are enamelled in the ordinary way.

The same process is applied to other goods in order to avoid riveting, and one other advantage is the one of greater permanency in point of mechanical strength, where the goods are alternately heated and cooled. Under this condition of heating and cooling, rivets were often becoming loose, and so occasioned trouble. Galvanized work can be spot-welded. The zinc volatizes off, leaving the iron exposed at the point where the dies come in contact with the metal.

The acting electrodes can be made into various shapes to suit special work. Thus, one can be made circular, freely movable on its axis, while the upper one may be formed of a circular piece of copper swung by a lever. Such electrodes are useful for welding short seams, such as triangular spouts of coffee pots, etc. As the pressure put upon the material is very high, it will be understood that there is hardly any difference in strength between the welded portions and the unwelded material.

Rubber and Carbon Dioxide

A GERMAN chemist, F. Steinitzer, has investigated the absorption of carbon dioxide by rubber and the passage of the gas through rubber membranes, from the standpoint of its use for the inflation of pneumatic tires. He finds that various qualities of rubber used for the purpose show different absorptive powers toward the gas, varying from about 25 cubic centimeters in the case of a heavily loaded gray inner-tube rubber, to 131 cubic centimeters in the case of a best red Para rubber per 100 grams of rubber. The samples were exposed in an atmosphere of dry carbon dioxide at a pressure of 1 kilogram to 1.5 kilogram per square centimeter for periods of from 5 to 8 days for the various tests referred to. Certain of the samples, notably the purer ones, became more or less tacky on absorbing carbon dioxide, and a decrease in tensile strength of from 12.6 to 27.5 per cent. was sustained. In the diffusion tests, the area of the test-piece was 22.3 square centimeters, and the pressure of the carbon dioxide on the high-pressure side 1 kilogram per square centimeter. Some time passed before diffusion began, after which its rate showed only a slight diminution in 10 days. The rate of diffusion increases with higher temperatures, being with sample No. 4 at 10 degrees, 15 degrees and 20 degrees, 0.00200 cubic centimeters, 0.00229 cubic centimeters and 0.00266 cubic centimeters respectively per square centimeter per hour. A solution of 10 to 15 parts of glycerine and 20 parts of glue in 100 parts of water is recommended for producing a thorough gastight coating on the inner surfaces of the tubes.—*Engineering*, Sept. 6.

Heat and Platinum Metals

IN the Proceedings of the Royal Society for 1912, Sir William Crookes gives the results of experiments suggested by his experience with an electric resistance furnace. He found in this apparatus, which consisted of a close helix of platinum strip around a porcelain tube, that the strip thinned and ultimately melted, and on the porcelain tube at the pont of rupture a deposit always occurred, which was found to consist of microscopic hexagonal crystals of platinum. He was thus led to examine the volatility of platinum and the allied metals at temperatures below their melting-points. The metal samples were heated in the electric furnace to 1300 degrees Centigrade for successive periods of 2 hours, when the loss of weight was found to be approximately proportional to the length of time of the heating.

After exposures to 1,300 degrees Centigrade, the platinum had not sensibly changed its appearance, the palladium gradually lost its smoothness and became crystalline with a *moiré* appearance, the iridium showed the same change in a higher degree, while the rhodium slightly darkened, but did not become crystalline. The ruthenium plate, which is very noteworthy for its high volatility, became dull black and was coated with oxide. With iridium, the amount of loss for equal periods of heating at temperatures between 1,100 degrees and 1,400 degrees Centigrade increased proportionally with the rise of temperature. With palladium the loss of weight was more rapid in the earlier stages and the blistered appearance of the metal indicated the escape of occluded gas.—*Engineering*, Sept. 6.

Lengthening the Wheelbase; Novel Valve Action Suggested; Why Five Cylinders Are Not Used; To Add Clutch to Ford Car; Changing Magneto and Camshaft to Chain Drive; A Tempory Spring Clip

Wants to Lengthen Wheelbase

EDITOR THE AUTOMOBILE:—I have a 1911 Regal Roadster which is 100-inch wheelbase and I want to make it 118-inch. The motor is 3 3-4 bore and 4 1-2 stroke. Kindly let me know how much additional power it will require.

Fitchburg, Mass. J. D. G.

—Your motor will have sufficient power to operate the car with the additional wheelbase. The change is not recommended, however, as it will be very expensive if done well, and if it is not done well will weaken your car to a considerable extent. Radical changes in a chassis which has been designed with the special intention of making the parts fit together in one harmonious whole should be avoided.

Running with Dead Cylinder

Editor THE AUTOMOBILE:—If in a four-cylinder four-cycle engine running at about 250 or 300 revolutions per minute with one cylinder disconnected, the petcock to that cylinder were opened, would it affect the speed of the engine, and, if so, would it increase or decrease the speed?

New York City, N. Y. L. E. HOWE.

—If the petcock were opened the speed would probably be decreased. This is true for the following reason. The opening of a petcock is so restricted that the cylinder on its upstroke would have to work against a large degree of compression due to the fact that the air could not escape through the opening rapidly enough. Were this compression maintained as it would be if the petcock were closed, the piston would be assisted on its downward stroke by the expansion of the air compressed on the upstroke. Instead of being aided, however, by the air the latter will have escaped to a large degree through the open petcock during the time the piston was near top dead center and going through the slowest part of the stroke. The result is that on the down stroke the piston will have to pull against a partial vacuum which will further retard its progress.

Wants Parts for the B.L.M. Car

Editor THE AUTOMOBILE:—Could you inform me where I can get parts for a B. L. M. runabout or who took over the stock of that company after they went out of business?

The office of this company was in Brooklyn and the car was made by three men by the name of Breese, Lawrence and Moulten. As far as I can find out this car was made abroad and assembled here. The car I have is the same as those that were entered in the Vanderbilt Cup Race held about 4 or 5 years ago.

Woodmere, L. I., N. Y. Q. F. DISHER.

—This concern went out of business and no one took over the stock or parts. P. H. Gill & Sons, 2 Lorraine street, Brooklyn, made a number of the parts for this car, however, and they may be able to assist you. The motor and several parts were made in Europe as you supposed and then assembled in this country.

Suggests Novel Valve Action

Editor THE AUTOMOBILE:—I have designed a valve action which is new and which I think would be silent as well as of long life. The method of actuating the valves is shown in the accompanying sketch, Fig. 1. It consists of a worm-driven transverse shaft upon which are located a series of eccentrics which are used for driving the rocker arms communicating motion to the valves.

On the end of the crankshaft is located a worm A which engages with the gear B, mounted above it. The gear B is mounted at the center of the transverse shaft C, and is keyed to the latter. As will be seen, the shaft C rotates in two long sleeve bearings and terminates with two cams or eccentrics at either end. The eccentrics D, E. F and G then operate the inlet and exhaust valves, as shown on the left side of the illustration. The eccentric T is connected in such a manner to R that the latter is free to oscillate and at the same time to communicate a reciprocating motion to the shaft S. Through the flexible connection M the bell crank lever O is actuated, moving the rocker arms L which in turn lift the push rods Q. The valve return is secured by the valve springs in the same manner as is customary when cams are used.

Philadelphia, Pa. J. M. WHITE.

Experience with Five Cylinders

Editor THE AUTOMOBILE:—For the benefit of some of your readers who wonder why five-cylinder engines are not used more extensively, I would like to tell of my experience with them and some reasons why they are not more popular.

A few years ago I had occasion to couple together five single cylinders and install in a cruiser. They were all mounted on a heavy cast-iron subbase with thin cranks set at a difference of 72 degrees. The forward cylinder retained its original balance wheel, the other being discarded. After installation I found that it was much superior to a four but in the same way that the four is superior to the three. I cannot say that it even equaled the six in any way whatever. (I am referring to four-cycle motors only.) It is true that in the five each explosion overlaps the next, but not sufficiently to produce the same constant torque that is produced by the six. The impulses in the six are numerous enough so that one does not finish its work before another has taken place and the piston on which it is acting is in a position to do its best, but in the five each piston arrives at the end of its useful stroke before the next one has taken a position where it can do much more than turn the balance wheel. For example, we will assume that we have a five-cylinder motor coupled to its maximum load, without a balance wheel, and we will create an explosion in a cylinder that has its crank enough past center (100) so that it could act. That explosion would turn the crankshaft 150 degrees where it would stop unless another explosion takes place to keep it moving. Now when the first crank passed the 144-degree mark another explosion will occur, but the second crank will not ar-

rive at the 10-degree mark before the first one had lost its power, therefore it would not carry its load. In the six, however, on account of the impulses being only 120 degrees apart the load would be carried very easily, all other conditions being the same. The above figures, although not exact, illustrate a true condition. I think this proves that the five cannot equal the six for continuous torque.

There are other reasons why they are not more popular and I will mention the most important. The expense of manufacturing the crankshaft. When one stops to consider that the crankshaft is a pretty expensive unit and that two sizes can be turned out in the same time that one five can be turned out, he will not wonder why five-cylinder motors are not used.

For the benefit of those who might not understand why the six crankshaft is less expensive I will state that it has but three offsets on account of the cranks being paired together, while the five has five and cannot have any less.

Portland, Me. GROVER C. RICHARDS.

Wants Governor for Cadillac

Editor THE AUTOMOBILE:—Do you know of any governor that would be suitable for a one-cylinder Cadillac?.

Niagara Falls, N. Y. R. N. PATTISON.

—An ordinary centrifugal governor could be used on a motor of this kind. Any competent machine shop can install one and the cost would be small. The governor could operate the throttle or it could be attached to the ignition and the motor governed by the hit-and-miss principle. That is to say, when the speed of the motor increases beyond what is required, the ignition is either switched off or short circuited so that there will be no explosion until the motor slows down again. The latter method is a little more expensive as to fuel because the charge is drawn in and exhausted without being burnt.

Lightness Lengthens Car's Life

Editor THE AUTOMOBILE:—Which is of longer life—conditions in both cases being the same, a roadster or a touring car, the chassis in either case being the same? Is not a roadster more economical in every respect, as regards upkeep, than a touring car? What is the most satisfactory arrangement of four forward speeds for country use?

Plattsburg, Mo. M. W. BOHART.

—Everything else being the same a car of lighter weight costs less to keep it up because the tires are not worn as quickly. A man who keeps a roadster and a touring car will find that at the end of year the touring car has cost him more because the expenses included in entertainment will have amounted to considerable more. Should it be necessary to carry three or more people, however, a touring car is necessary. There are many occasions where the owner of a roadster will be unable to accommodate guests whom he desires to take with him on a ride but as far as the expenses of running, such as fuel consumption, etc., are concerned, where the chassis are the same there will be no perceptible difference.

This is a question which has been provocative of lengthy discussion among very prominent engineers. You are referred to THE AUTOMOBILE of July 18, in which practice on this point was fully discussed. In specific answer to your question, however, it may be stated that the following ratios have given satisfaction:

Speed	Table No. 1 Trans. ratios	Ratios—engine to wheels
4	.86—1	3.01
3	1—1	3.5
2	1.76—1	6.16
1	3.4 —1	11.90
R	4.6 —1	16.10

Speed	Table No. 2 Trans. ratios	Ratios—engine to wheels
4	1—1	3.5
3	1.29—1	4.51
2	2.1 —1	7.35
1	3.76—1	13.16
R	4.57—1	15.99

The ratios given in table 2 are recommended because it will be seen that, when it is necessary to change from fourth to third, a speed is obtained which enables the car to go over the hill at a fairly good rate. The second in this is almost between the first and second of the others; consequently, if the car is fitted with a good clutch, the operation for all ordinary driving resolves itself down to a three-speed job (as the second can be used for starting on the level), leaving the extremely low first and reverse for emergency.

On Mounting of Ball Thrust

Editor THE AUTOMOBILE:—In your answer to J. J. Lessing, relating to mounting of ball thrust bearings in motor car clutch, in the issue of November 14 I perceived with some degree of interest the illustration, Fig. 2, showing a ball bearing in place, which you have, no doubt, intended to show your correspondent as a typical construction. The bearing shown is a single row type of the conventional annular pattern and merely supports the end of the shaft that telescopes into the hub of the clutch driving member. Bearings of this type are not suitable to re-

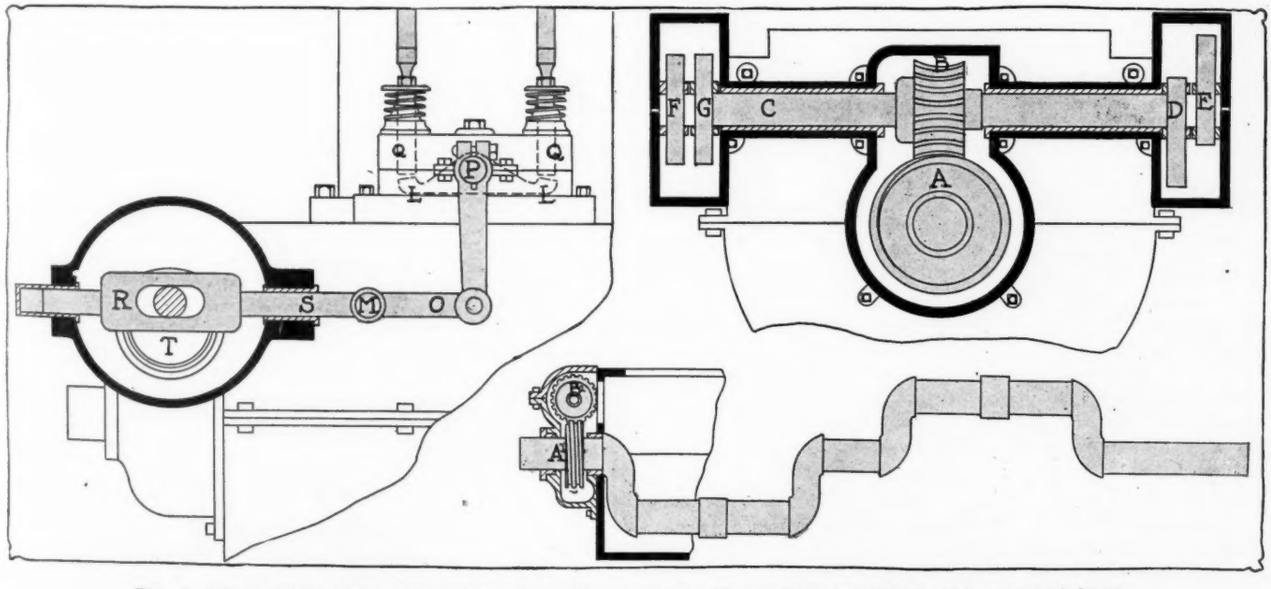


Fig. 1—Worm-driven valve action designed to silence motor. Three views are shown, end, rear and front

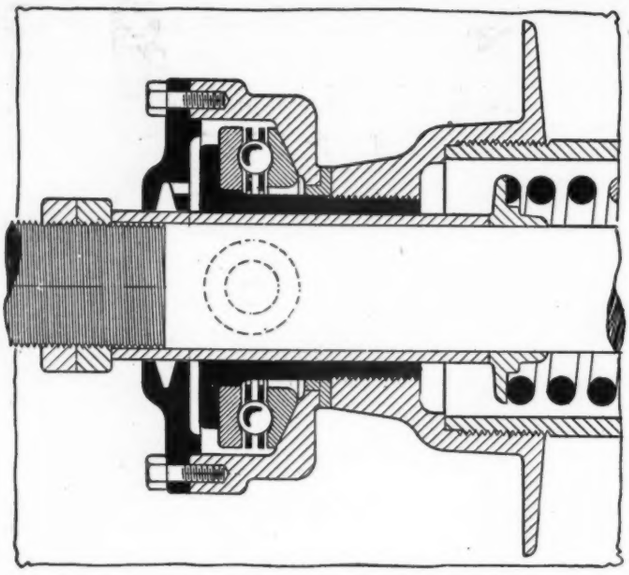


Fig. 2—Mounting of ball thrust on clutch explained below

sist end thrust greater than 25 per cent. of their radial load capacity, so it is difficult to understand how this bearing performs any other function than to support the end of the telescope shaft. No exception can be taken to the explanatory matter, but the illustration is misleading. In order to assist in making this matter clear, I am sending herewith illustration of a typical clutch and gearset assembly, showing clearly the application of a ball thrust bearing as ordinarily mounted. The clutch spring is usually installed so the thrust, when driving, will be self-contained; that is, the pressure of the spring does not exert any thrust against parts not turning with it.

In Fig. 5 you will note that the driving disks C are carried by a member E driven by the engine, while the driven disks revolve with a special member F keyed to the telescopic shaft and extending to the spring thrust abutment screwed on the extension. The clutch actuating spring is mounted outside of this extension sleeve as indicated. When the disks of the clutch are locked together by spring pressure, the spring thrust exerted directly against the abutment at one end, and the pressure member at the other is self-contained, because the parts are virtually locked together and revolve as a single unit. The spring presses against the disks, these in turn against the back plate, forming part of the member carrying the screwed on spring abutment. The ball thrust bearing G shown is under absolutely no thrust load when clutch is driving shafts of gearset. If it is desired to release the clutch, the clutch throw out yoke bears against the radax or cup and cone type thrust bearing outer race, then this member transfers the pressure (opposed to that of the spring) through the medium of the balls and inner race mounted on clutch spring enclosing annulus. This member is drawn back when the pressure applied exceeds that of the spring and as the spring is compressed, its pressure and consequently the degree of frictional adhesion between the disks becomes less until the driving contact is broken. It will be evident, therefore, that the ball thrust bearing is used only when clutch is released. The bearing for telescoping shaft is, therefore, subjected to very little, if any, end thrust.

In practically all clutch designs, the only time the ball thrust bearing is in use is when clutch spring pressure is relieved to break driving contact between clutch members.

Bristol, Conn. VICTOR W. PAGE.

Want Four-Speed Light Car

Editor THE AUTOMOBILE:—I wish to thank you for the stand you take regarding the introduction in this country of lightweight, small horsepower, flexible cars with four-speed gearbox equipped with wire wheels. I have wished to buy a new car for some time past along these lines, but so far have not found a single domestic manufacturer who makes a car along the above lines, and the price of a foreign car with the duty added is too expensive. I sincerely hope that before a great length of time that this sort of car will be produced, as there is already a great demand for it and I feel sure that there would be a ready sale. In the small town in which I live on Long Island I have several friends who would buy a car of this nature.

In case you know of any domestic manufacturer who is contemplating the manufacture of a car along these lines I would consider it a favor if you would furnish me with his name and address.

New York City. W. H. FALLS.

Wants to Add Clutch to Ford

Editor THE AUTOMOBILE:—I have a Ford model S roadster. I cannot keep the grease in the planetary transmission. I have tried almost every grease on the market. At present I am using Dixon's fiber grease. It certainly reduces the noise somewhat, but it slowly, but surely, works out. Would it be possible to put a positive clutch or a clutch that could be engaged gradually on the transmission in the place marked on Fig. 3 at A, so that the high could stay in while on neutral and just a few seconds before starting pull out the high, engage the proposed clutch and then again shove in the high. The object of this clutch is to eliminate noise while on neutral. Complication of control is no objection.

St. Louis, Mo. TRANSMISSION.

—You are running with a gearset which has become worn out. This accounts for the noisy action. It would be cheaper and more satisfactory to replace the worn parts than to attempt to fit the clutch, which would necessitate so many changes that it would be impractical. In order to prevent the working out of the grease you could have an aluminum casting made, such as is used in the model T. This would rest on the side members and would allow the gearset to set down within the bottom casting. Over the top of this would fit a coverplate that would enclose the gearset with an oil-tight gasket. In order that the fiber drums will not slip when covered with grease and cause lost motion, they should be removed and asbestos fabric substituted. The castings can be easily and cheaply made by your local foundry.

Changing to Chain Drive

Editor THE AUTOMOBILE:—Is it feasible to change the magneto and camshaft drive in a four-cylinder motor to the chain drive?

Hasbrouck Heights, N. J. F. W. HOBBS.

—This could be readily done, but it is doubted if the results would be as satisfactory as would be the case if you replaced your worn gears with others which fitted closely. The use of the chain entails the necessity of having a chain adjustment unless the center distances are exactly as required. This, taken together

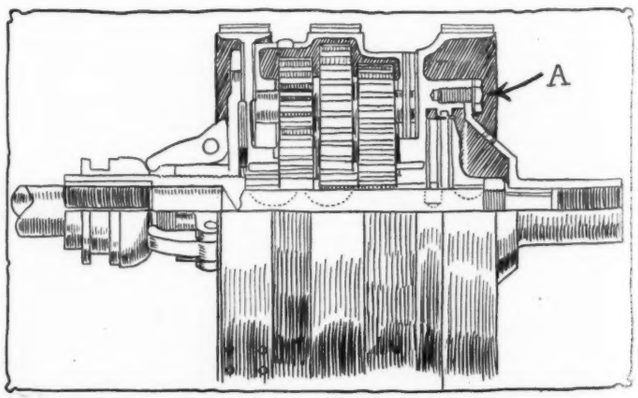


Fig. 3—Showing proposed location of clutch on Ford gearset

with the fact that the wheels would have to be replaced by others suited for the chains and that these wheels are wider by 100 per cent. in many cases, may render it impractical. On the other hand, however, it may be that the chain drive is well adapted to your car. The following data is necessary in determining if the chain drive would be applicable, and if so, what would be the size chain required:

1. Brake horsepower of motor at 1,000 revolutions per minute.
2. Maximum revolutions of engine.
3. Number of cylinders.
4. Pressure in pounds to lift each valve spring.
5. Will pump, magneto or fan be driven from crankshaft?
6. Ratio of motor to camshaft speed.
7. Ratio of motor to magneto speed.
8. Ratio of motor to pump speed.
9. Minimum bore of pinion to fit crankshaft.
10. Pressure per square foot of exhaust gas at opening of exhaust valve.
11. Diameter of valve head.
12. Weight of valve and tappet.
13. Profile of cam.
14. Details of any dimensions that are limited by conditions.
15. Rough sketch showing the disposition of the drives and the desired working center to be attached.

The above is a copy of the form sent out by the Coventry Chain Company, of England, which is represented in America by the Sarco Engineering Company, 116 Broad street, New York City.

Percentage of Slip of Wheels

Editor THE AUTOMOBILE:—Why are not speedometers attached to the rear wheels of a car? Is there no way of eliminating the complicated mechanism necessary for attaching the speedometer to the front wheels? What is the cause of the comparative inaccuracy of a speedometer? That is, why will one instrument measure a certain distance over a certain stretch of ground while another, mounted on a different car, will give a distance which is at distinct variance with the results given in the first case?

New Rochelle, N. Y. OSCAR WHEELEN.

—The mounting of the speedometer upon the rear wheel would be the cause of great inaccuracies because the rear whels have more slip than the front wheels and because the differential action would interfere to some extent. Henry Souther, former president of the Society of Automobile Engineers, compiled some useful information on the slip of rear wheels at the Brooklands track in England. The following tabulation prepared by him after carefully investigating this question throws considerable light on the matter:

Percentage slip	Speed
.3	40 miles per hour
.6	50 miles per hour
1.1	60 miles per hour
1.8	70 miles per hour
3.7	80 miles per hour
5.4	90 miles per hour

It will be seen from the above table that traction is better at low speeds than at high. The tests were made with plain round tread tires. It was noted that the inner wheels slipped a little more than the inner while rounding a curve at speed, because the centrifugal force tended to remove the weight from this side. The Knox Automobile Company has mounted the speedometer upon the drive shaft for next year. This does away with the complicated mounting and enables the makers to place the speedometer where they desire without having any difficulties with the flexible shafting. The difference in two instruments may be due to many causes, such as inherent inaccuracies, improper mesh of gearing, rough roads, etc.

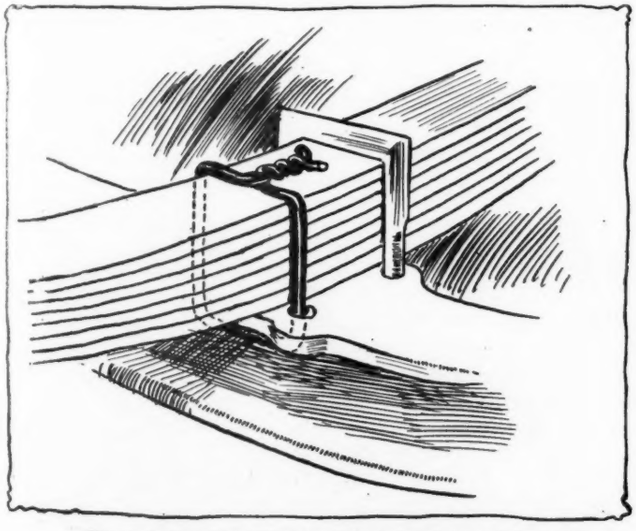


Fig. 4—Temporary repair replacing missing spring clip

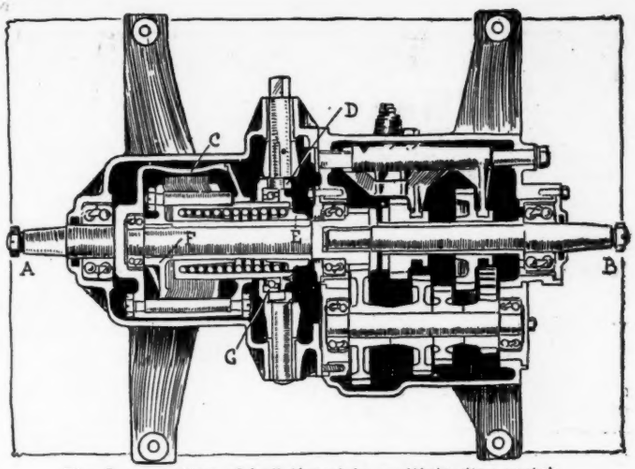


Fig. 5—Mounting of ball thrust in multiple-disk clutch

Tires Stick to Rims

Editor THE AUTOMOBILE:—I am going to put up my car for the winter season and I would like to know how to prevent an annoying trouble that caused me a large amount of distasteful work with emery paper this spring. The rims became so rusty that I could not put tires upon them until the rust had been removed. I live in a very damp climate and as the air is somewhat salty its action on metal is very rapid.

Freeport, N. Y. B. T. HAFF.

—The best way to avoid this trouble is to clean your rims thoroughly with kerosene when you remove the tires for the winter, and then to paint the rims with graphite paint.

Made Temporary Spring Clip

Editor THE AUTOMOBILE:—The other day, after I had accidentally discovered that one of my front spring clips was missing, I had a temporary repair suggested to me by a member of our party which proved of considerable value. In my tool kit I have always made a practice of carrying some stout pieces of wire for emergency. We took one of these pieces of wire, about 14 inches in length, and bent it into a U shape. This was slipped up through the holes used for the missing spring clip, as shown in Fig. 4. The two loose ends of the wire were then loosely twisted together and a strong screwdriver inserted in the loop and used as a tourniquet. By turning up tightly on the screwdriver the wire was brought strongly up against the spring and then bent down. We had a run of about 200 miles over rough country before we arrived home and the repair held excellently. I would advise any automobilist to do this rather than run any distance with a missing clip.

White Plains, N. Y. T. D. F.

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Redesigning the Body

WE are trailing—Europe is leading.

The Englishman with his round-the-world reputation for comfort is to-day setting the pace in automobile body design. It is meet that he should fill this rôle in so far as comfort is concerned, but it is further true that he wears the rôle of leadership in design also.

At last the English designer, who is generally a French importation, has recognized the fact that **body design begins with the radiator and ends with the baggage rack or license light.**

Up to the present the body design started at the dash or ended with the tonneau. There was no harmony between the bonnet and the body. The same radiator or bonnet were used for the runabout, the berline, the coupé or the seven-passenger tourist. The same straight-line bonnet and radiator lines were used whether the body were a stream-line creation, a straight-line design, a combination curve and convex or a torpedo model. To-day nearly all American makers are still doing this, so are the majority of the European builders, but the end is in sight.

Art is entering into body building.

Because a man wears a cuff on his outing trousers does not call for such decorations on his evening suit. The red necktie may be correct in the business office, but it is, nevertheless, unpardonable at the banquet table. So with the bonnet on the car. It is an integral portion thereof and must be considered a part of the body design.

The days are passing when a maker will refuse to alter the bonnet shape or radiator design solely because he looks upon it as a recognized trade-mark or name-plate. While there is a stock-in-trade value in respect there is also a deterioration in appearance.

To date many body designs have been but compromises. The body builder, a graduate of the horse-carriage trade and hopelessly ignorant of the automobile chassis, set boldly at a task, a task which began at the dash and worked back to the rear end. He was not even permitted to make the bonnet. The buyer who purchased a chassis also purchased a bonnet, and while the carriage builder was given carte blanche in body lines he could not even alter the bead work of the bonnet or a line on the dash. The resulting body was a natural sequence—a two-part affair, one the radiator, bonnet and dash, the other the body proper.

The recent Olympia has demonstrated that the renaissance has begun. The designer has included the bonnet and dash in the body proper. Before him is no easy task. He has started valiantly, however. To accomplish the task has consumed space in some models. Space is needed to imperceptibly mold the body into the dash and bonnet. But even here economy is at hand, a gasoline tank has been taken from under the front seat or from the rear of the chassis. This leaves more available baggage space, gives shorter gasoline connections and makes gravity feed feasible. While doing all of these things it offers a solution of the hollow dash, a dash which forms a pleasing transition between bonnet and body.

But the end is not yet! **The top will have to be improved.** As to form, there is little certainty. It may be that when the top is folded it will disappear within a space in rear of the tonneau upholstery, so that a leather flap will hide it and give a completed finished appearance. Some day the spare tire and spare wheel problem will be solved. These will be concealed within the body, or, in other words, the body will be designed to contain them. More adequate baggage space must be provided.

Europe for 1913 is experiencing a return to the four-passenger body, as compared with the pronounced tendencies to five-passenger designs of the last 2 or 3 years. The onward march of the small motor has partially caused this, but it is also true that the four-passenger size has a broad field and is more comfortable for a load of four than a five-passenger style.

Many foreign countries are leading us in the vital question of weight reduction. American cars are to-day too heavy for their general design and also their requirements. A leading maker recently stated that carrying the two demountable rims with tires in rear of the tonneau was equivalent to two 200-pound passengers in the tonneau. This is an enormous load, carried as it is well in the rear of the axle where its side-slip, as well as its vertical whip, is maximum. Such a load racks the chassis, makes steering more difficult and wears out rear tires.

Manufacturing Success Points to Concentration

George W. Bennett's Address Before the N. A. A. M., Outlining the Subject at Greater Length Than Appeared Last Week Brings Out New Thought on Close Relationship of the Maker with Men Who Distribute His Product

THE trend of success in the automobile industry today is unquestionably pointed toward concentration, and concentration is not possible where the product is divided into several models. **Little doubt exists in my mind but that eventually the marked successes of the automobile business will lie in specializing, each plant making that which best fits its demand, and making that model in the quantities to which its place in the automobile market entitles it.**

To make several models in a factory which is equipped to make not more than one satisfactorily, necessarily restricts the output of that plant and divides the energies of its engineers, its operatives and its selling force into several small channels, all of them considerably below par in efficiency because of such division.

Experience has shown that there exists a market for a certain number of cars at a certain price, each of a different class, and each appealing to a different grade of buyer. The growth of the industry shows that the most prominent manufacturers have realized this and are catering to the class they can best supply.

I believe this development will become more marked and that in a very few years each factory will limit its product to one model, with perhaps several styles of bodies interchangeable on the chassis.

One Chassis Type Not Always Possible

It may not always be possible for one manufacturer to profitably restrict himself to one chassis, but it will be possible, if more than one is considered necessary, to make a large number of the parts interchangeable, and only in this event would the production of two models be warranted or likely to be successful. We are all familiar with the most striking success in the industry, who for the past 3 or 4 years has made practically no changes in his chassis, who makes his various styles of bodies fit that one chassis, and has limited himself to that one model, producing it in immense quantities.

I do not believe his success can be duplicated, since the existing product practically fills the market for automobiles of that price. Nor is it possible that any other manufacturer can compete with him, as the model in question is the culmination of many years' experience in building that particular type, and of daily and prolonged thought to economy in its manufacture.

I am fairly well satisfied there is no other equally large market available, the demands for cars of higher price being necessarily limited by the decreasing number of individuals whose incomes are sufficient to justify the greater expenditure. This decrease becomes more marked as the prices go up. It will take a cleverer statistician than I am to compute the possible markets along this line, although it must be clear to those who have given the matter any thought that the quantity market for each class of car is limited to the possessors of sufficiently large incomes to make the purchase. It is a point, however, that should be seriously considered by every manufacturer today. **Obviously there are more manufacturers of automobiles than there are classes of purchasers, and the process of elimination, which it must be admitted is working fairly fast, must in the near future determine that ratio.**

Furthermore, the subject of subsequent service is involved so much that where more than one model is built adequate service to the user is difficult, and consequently seldom satisfactory, and without that satisfaction complete success is impossible.

In view of the endeavor of the pioneer manufacturer to supply his dealer with a complete line, and admitting in the majority of cases his necessity, and further having in mind my remarks as to concentration by manufacturers, I think the same result will be accomplished by a different method. Dealers who are limited by their agreements with manufacturers to sell only the one line, are necessarily restricted in their markets and in their earnings. This course invites competition among dealers, adds to their number many who are irresponsible, and the final result is that but few of them at the end of the year show any profit. With the idea of concentration carried out by manufacturers, it would necessarily follow along to the dealers, and would result in each dealer having a line no two models of which would be competitive in price, or similar in general detail, and which would enable him to cater to more than one of his markets.

The manufacturer cannot be successful unless his dealers are successful, and their interests are so interwoven as to be identical and absolutely dependent each upon the other. I venture to assert that this phase will receive considerably more thought in the future than it has in the past.

It would be expecting rather too much to hope that we shall be able so to arrange the production of automobiles that all of us will prosper and each occupy his own niche in the industry. I believe, however, that this association, which comprises most of the manufacturers of automobiles in this country, is in a better position to accomplish approximately this than any other agency that can be imagined. We have no factions, no politics, no patents, and, so far as I know—and I speak with some authority as to the executive committee—every individual comprising the working end of the association is working for its benefit and for the harmonious operations of the industry.

Association Another Form of Concentration

It would be anticipating the millennium to believe that any of us—myself included—is going to bare all his inner thought to public gaze or even to that of his fellow members, but I am certain that the closer we keep together, the oftener we have these meetings, and the more freely we interchange ideas, the better it is going to be for all of us. We are all fairly experienced men of the world, and while, as I say, none of us is likely to speak with absolute frankness, I believe the lines of thought disseminated at such meetings as this, properly analyzed and considered—as they are likely to be by those hearing them—will have the effect of unconsciously shaping our plans to the desired end, so that eventually we shall all be moving along the line of least resistance and accomplishing that which we deem success.

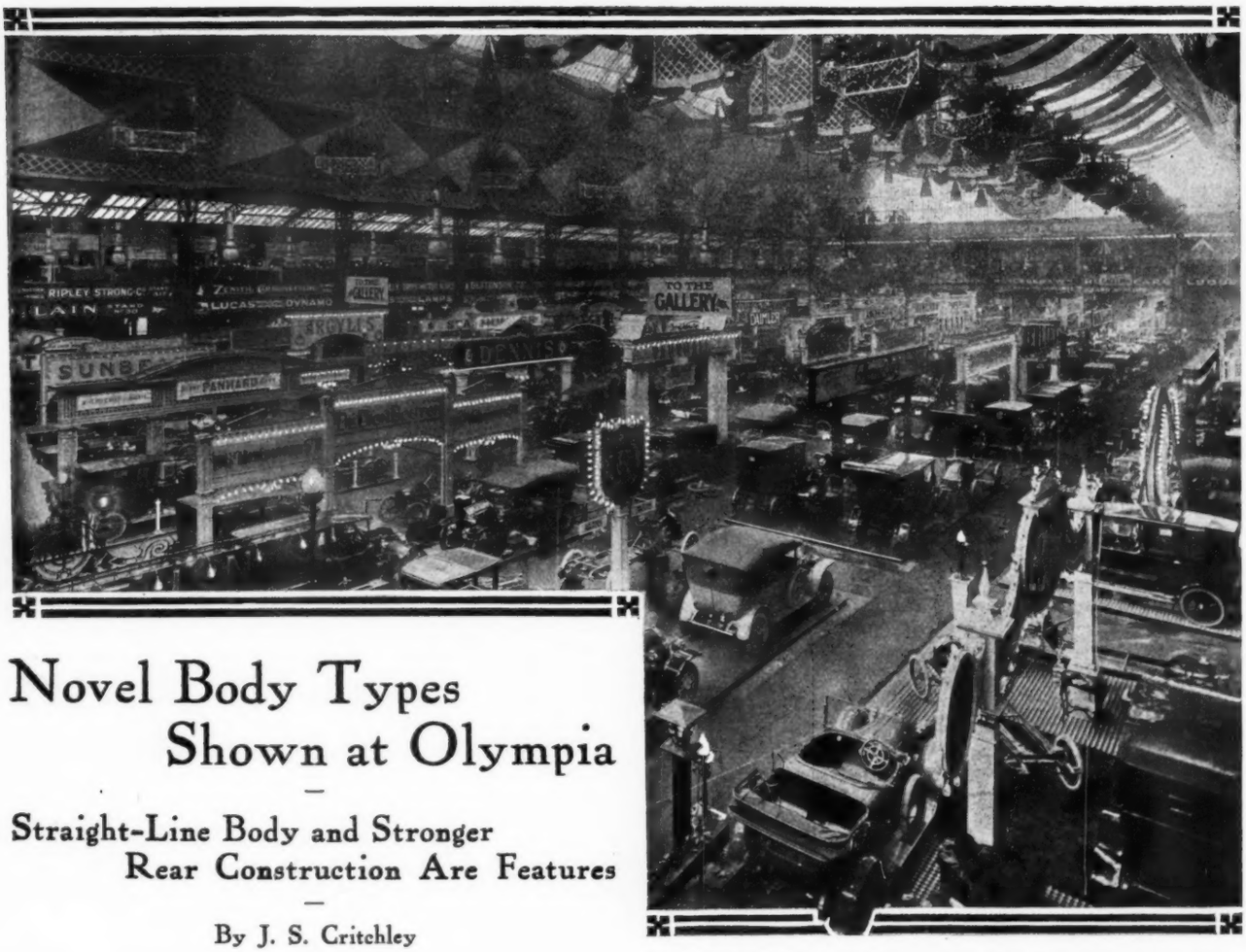


Fig. 1—Bird's-eye view of Olympia during first week of the show

Novel Body Types Shown at Olympia

Straight-Line Body and Stronger Rear Construction Are Features

By J. S. Critchley

OLYMPIA continues to show the tendencies of European design as in previous years. Primarily an exhibition of expensive cars, it is only to be expected that luxuriant body work will be exemplified in the cars which are seen here. That this is true will be seen in the brief descriptions of some of the more noted types, given at the end of this article.

Last week THE AUTOMOBILE dwelt at length upon the developments of the motor, clutch, gearset and rear axle construction. Continuing a detailed study of these features before commencing the investigation of the body, some of the types which stand out on account of noteworthy design will be mentioned.

A few of the most important developments should be described, however, apart from the individual description. The worm drive is one of these features.

One of the questions which has not been fully decided in either English or Continental practice is whether the worm should be mounted above or below the gear. There are two reasons for this uncertainty on the part of designers. The first is the fact that when the worm is below the gear, lubrication is easy. The oil being in a pool in the lower half of the housing is generally of sufficient depth to submerge the point of contact between worm and gear teeth. The advantages of this are readily apparent. Wear is reduced to a minimum, the worm is rendered, if possible, even more silent in its action and the length of life of the bearing parts is indefinitely extended.

On the other hand, however, there is the question of road clearance. Foreign practice, while less exacting in this respect than American, still calls for at least a minimum of 7 inches.

Another point which attracts considerable attention is the mounting of torque members and the general distribution of stresses throughout the rear construction. It may be of interest in this connection to refer to Fig. 3, which shows a plan view of the four-cylinder, 15.9-horsepower Arrol-Johnston chassis. As may be seen from this illustration, the side channel frame members are swept in at the rear and firmly joined by a gusset plate which constitutes a horizontal web, thus producing a remarkably rigid structure at this point and one which would be practically impregnable against all ordinary racking strains. The torque tube is still in common use and there is no tendency for its abandonment, although the juncture of the torque tube to the frame and rear axle has been given more attention.

Springs, both in the mounting and shape, seem to be undergoing a process of development. The cantilever type of rear spring is increasing in popularity. The Rolls-Royce Company has changed to a spring of this type. The drive is taken through this spring and in place of the radius and torque rods a large, spherically ended torque and radius rod of circular section inclosing the propeller shaft is fitted. This means a decrease of weight, less expensive work and at the same time an equal amount of strength.

It is well known that in springs of the cantilever type means must be taken to prevent a lateral movement relatively to the rear axle. This is effected in the Rolls-Royce by collars formed on the rollers carrying the ends of the spring. Another interesting point in connection with this spring on the Rolls-Royce car is the provision of a safety stop which prevents the axle from leaving the frame should there be a fracture of the torque tube.

Brakes have not ceased to attract the attention of the designer. Improvements at this point have gone hand in hand with other

refinements about the rear end of the chassis. Fig. 9 shows how the back of the Sheffield-Simplex car is constructed. The large ribbed brakes are a prominent feature. The wide face of the brakes will be noted also. This is illustrative of a general increase in brake sizes throughout European practice. With the increase in body and chassis refinements, especially with the luxurious appointments of the former, an increase of weight has rendered necessary an increase in braking power. This has also made it necessary to maintain an extraordinary rigidity through those members which absorb the braking strain. For this reason we see an increase of the strength of the rear axle housings, torque members and, where the drive is carried through the springs, in the connections of the latter to the frame members.

Another feature for which perhaps the increase in braking power is responsible is the increase in transverse stiffening members at the rear of the frame. Referring again to Fig. 9, the channel connections at this point may be noted. The mounting of the gasoline tank between these members, while not really a structural feature, is of interest.

Before leaving the subject of springs, the reversion to the underslung rear under the Daimler car will be of particular interest. As shown in Fig. 11, this form of mounting permits of a flat spring when the car is under load. In the illustration just referred to it will be seen that the spring has a slight curvature. When under the load of the body and passengers this spring will be practically flat and horizontal. The use of the full elliptic rear on the Arrol-Johnston should also be noted. It will be seen in Fig. 5.

A complete gear is being fitted in place of the sector on many of the steering gears. The object of this is to provide for a change of the teeth which are in engagement with the worm as soon as they become worn. It is only necessary to revolve the gear through 90 degrees in order to secure a complete new set of teeth in contact with the worm. In this connection it would appear that the slight increase expense in manufacture was more than equalized by the increased possibilities of compensation for wear.

Before touching on a few mechanical features which were not in last week's article the marked developments in body work should be mentioned. In the higher-priced cars there seems to be no possible luxury that has not been incorporated. The convertible body, as it is understood in America, has not as yet forced its way on the British market. In place of this there is the cabriolet, which can be quickly changed from a town to a touring car. Landaulets, limousines and Berlines are meeting with considerable favor, although they are being modified more or less to follow the whims of fashion. Torpedo touring bodies, such as that shown in Fig. 10, are increasing in popularity. The scuttle dash also prevails to a noticeable extent. Dashboards, in the latest cars, are invisible, the upper end being flush with the straight-line body. Another marked tendency is that shown in Fig. 16, where there is no definite line to mark the junction of the hood and the scuttle dash. Bizarre types of body, while frequently seen at the exhibition, are not turned out in any of the manufacturers' stock models, being merely given as body maker's suggestions.

The bodies illustrated at the end of this article, other than the French diligence coach, are to be found in the regular stock bodies turned out by the car makers. The stripped chassis is disappearing and in its place the complete car is being marketed.

In the Vauxhall car both types of detachable wheel are in use, the wood artillery wheel and a double spoke wire wheel with the Riley locking device fitted. The same driving pegs are employed in each case. To revert to the axle itself, the main casting is steel, into which steel tubes are fitted. It will be seen at once that the entire weight is carried on these last mentioned tubes and not upon the axles, which have to take torsional strains only and are consequently fairly light in section, the diameter being 1 3-8 inches. Each hub is supported upon three ball journal bearings. The centers of the two outer bearings are 5 1-8 inches; the outer bearings have 3-8-inch balls and the inner and larger bearing 7-16-inch balls. At the inner end of each hub a substantial ballthrust bearing is provided, the balls being 7-16 inch in diameter.

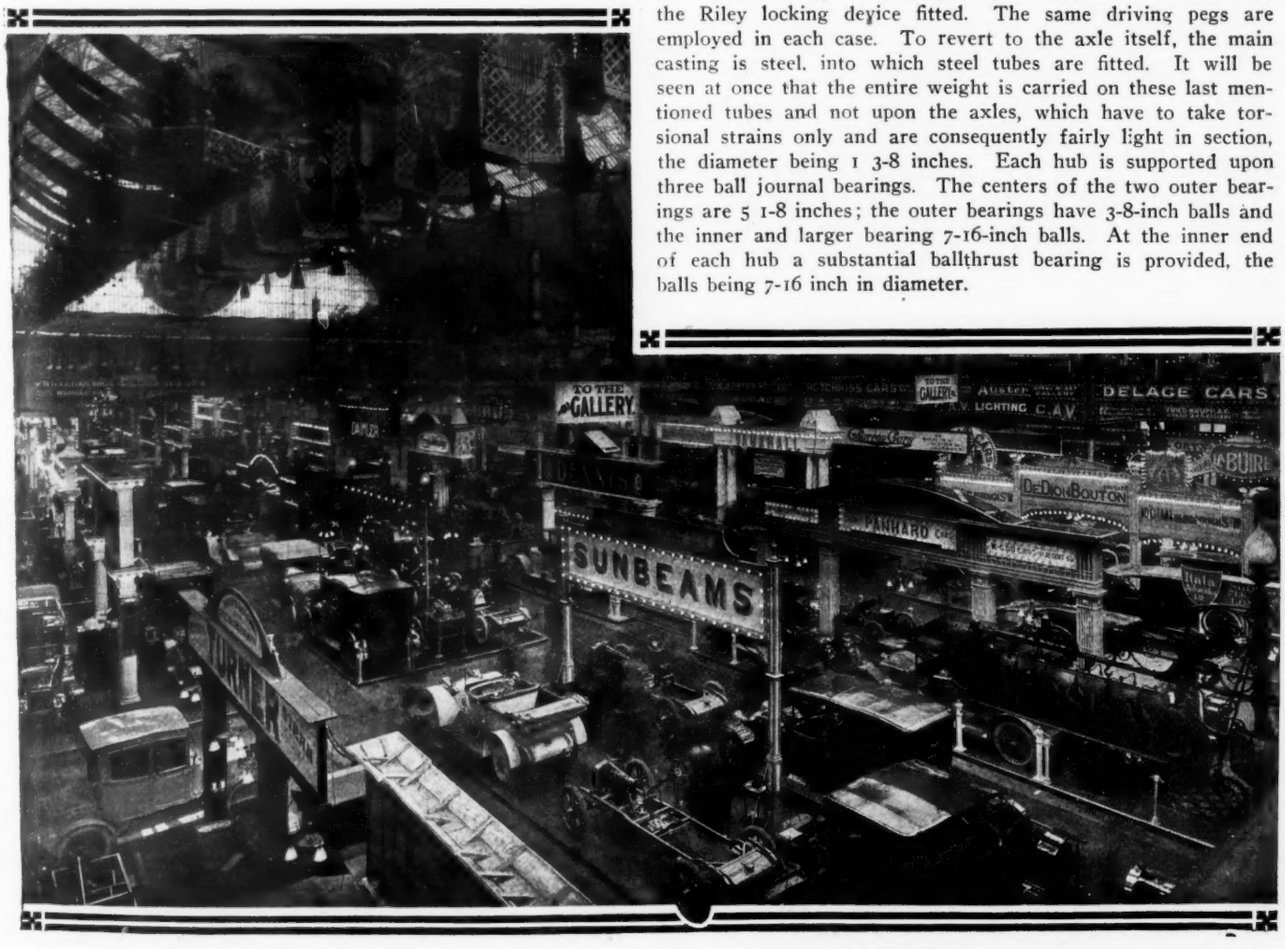


Fig. 2—Looking down one of the aisles of the English section of Olympia before the opening of the show

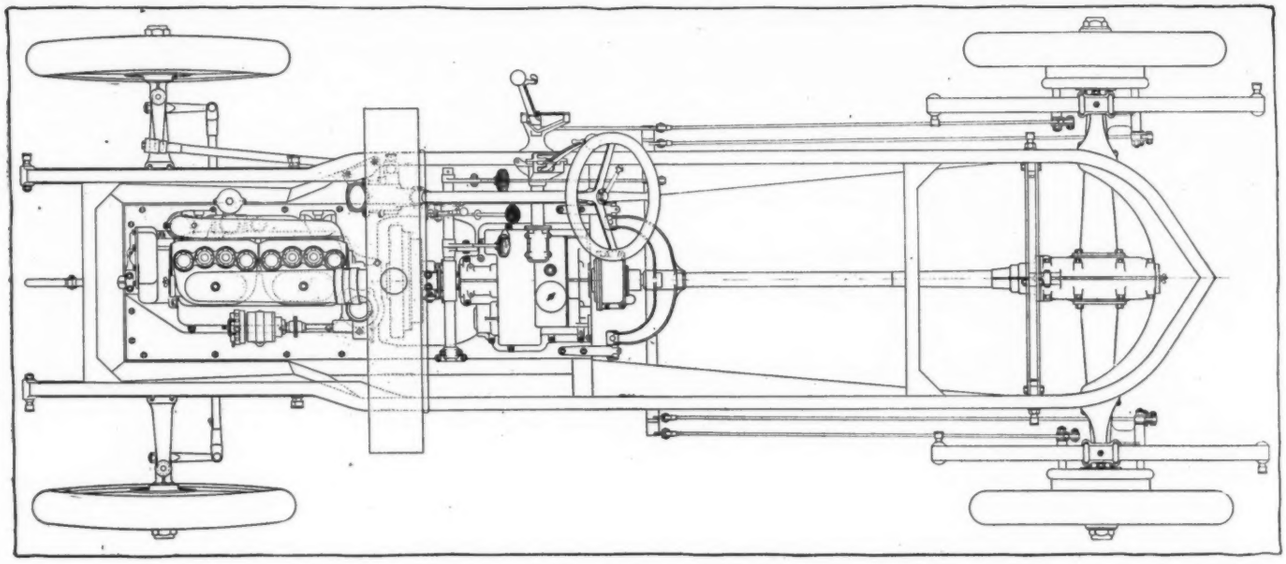


Fig. 3—Plan view of the four-cylinder 15.9 horsepower Arrol-Johnston chassis, showing the unique rear junction of frame side members

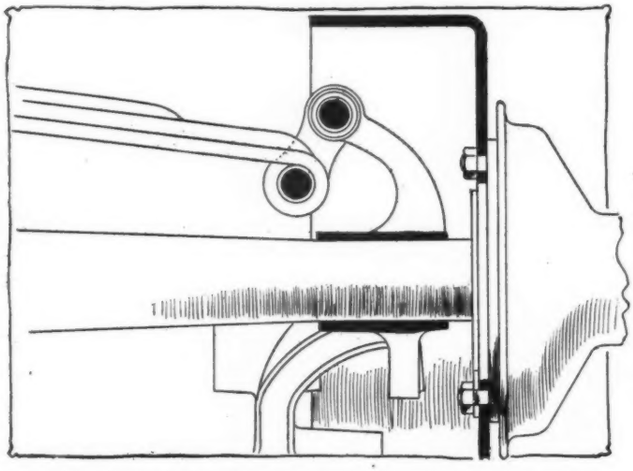


Fig. 4—B. S. A. transverse spring mounted on rear axle

It will be noticed that the rear of the B. S. A. frame is suspended from a single spring, Fig. 4, which is anchored to the center at the rearmost cross member and to shackles each side of the back axle. The gear striking rods are carried alongside the propeller shaft casing and partake of the same degree of radial movement as the propeller shaft; the gear change lever is coupled to the forward end of these rods in such a position that movement due to spring flexion, if it occurs at all, is very slight; in any case it has no effect upon the meshing of the gears within the box. The brackets for holding the back end of the engine are of good, substantial construction, and they can be clearly seen in the plan of chassis.

The chassis presents a very neat and simple appearance, the brake and other rods being all very direct, bell-cranks and such devices being conspicuous by their absence only.

Fig. 6 shows various views of the Belsize worm-driven back axle. The worm is of the parallel type and is situated above the worm wheel. This latter is a little unusual in its form. It has considerable width so that when bolted up in place it forms the outer casing of the differential box, the sides of the box being plain flange pieces with holes drilled to take the differential spur pinion. The construction is a very simple and cheap one, and does not appear to possess any bad points whatever, indeed each one of the parts is comparatively cheap to produce and therefore cheap to replace; there is perhaps a little more metal to the worm wheel than would usually be the case, but this is not a formidable objection.

It will be noticed that the differential spur wheels are cut solid upon the axles, which latter have a diameter of 32 millimeters. This gives a very strong sound job, but in the somewhat unlikely event of a spur tooth breakage it would be necessary to replace the entire shaft with its spur wheel cut upon one end and its other end splined to take the permanent hub. It is no very easy matter to decide how far to carry the once piece system in any design; carried too far it is an undoubted nuisance to the owner, in the case of breakage, and yet on the other hand the absence of any pieces fastened on, knocks out one possible source of trouble. It would seem that the particular piece of design referred to may be classed as good practice and not really objectionable. The greater part of the weight of the road wheels is taken upon the axle tubes, though there is a bending moment in the axle ends as well.

Means are adopted to prevent oil reaching the brake drums, for the screwed in plate that retains the ball journal bearing in position has at its outer diameter a V-shaped edge. Any oil flung from the edge of this when the wheel is revolving passes on to the light steel metal cover shown and cannot well reach the braking surfaces. The brake drums have a diameter of 10 inches and the shoe width is 1 3-8 inches.

The axle is braced by a steel tension stay 7-16 inch in diameter; this is attached beneath the spring seatings and passes under the axle casing. It will be noticed that instead of using a double ball thrust bearing at the back of the worm as is usual practice, single thrust bearings are employed and these are placed outside the journal bearings. Such an arrangement is perhaps conducive to cheapness, but it possesses the objection that if the worm and its shaft become at all heated—as it is quite likely to—the expansion throws an altogether unnecessary load upon the ball thrust. Perhaps the makers allow for this fact by permitting a trifle of end play for the worm shaft; if this is the case the matter must be attended to in the assembling as there is no possibility of after adjustment.

The Wolseley differential case is made of malleable iron and split vertically, being strengthened with an under tension stay. The worm and shaft can be removed without dismounting the axle, and the worm is of steel hardened and polished, with a worm wheel of phosphor bronze. The differential ends of the driving axles are mounted with ball bearings and the thrust provided against by ball thrust washers, and felt pads are employed to retain the oil. The drive is taken through the springs and torque rod is provided, the fore end of which is anchored to a

spring mounted link secured to the frame cross stay. All spring joints are as a matter of course fitted with grease cups.

On the Vauxhall car the lock nut used in connection with the Riley wheel is of interest, inasmuch as in place of the usual double lock with which it is customary to furnish a detachable wheel, there are in this case to all intents and purposes three locks. Two of the small spring catches in use can be observed in the figure, and over one of them is a pivoted cover or flap, which also serves the purpose of a lock. Further details will perhaps be out of place just here.

The differential gear is of the strength spur-pinion type and is perhaps a little stronger in construction than is usual, for the wheels are of good sinze and have a pitch of number 6. The ball journal bearing that supports the driving axle close against the crown wheel is a strong one and has balls 5-8 inch in diameter. Close alongside it is a thrust bearing to take the thrust due to the bevel drive. The bevel pinion which is one piece with its shaft is exceptionally well supported, as will be seen by an examination of the figure. There are here three journal bearings as well as the usual thrust bearing. It would seem that throughout the axle the designers have been at great pains to insure that no ball bearing shall be overloaded, as not only are the bearings large but in several cases they are in duplicate. In the whole axle there are no less than fifteen ball bearings—a number that would have been considered extravagant a few years back. The crown and bevel wheels have a pitch of 5 and the teeth are 1 1-2 inches wide. When necessary the bevel pinion can be removed by swinging the propeller-shaft clear and removing four nuts on the front casing. The axle casing is filled with oil through a filler projecting at the back; the top of the filler mouth corresponds with the correct oil level in the axle case, so that it is not possible to pour in more oil than is necessary. The rear axle brake drum and the shoes can be seen in the drawing, but as they are of fairly usual construction they do not call for any special comment.

On the steering gear a noticeable feature is that the worm shaft is supported by roller bearings and it is presumed that the substitution of roller bearings for ball bearings gives a greater freedom for the steering; if this is indeed the case then one can well approve of the alteration. A complete worm wheel is used in place of the perhaps more usual sector, and since only above 90 degrees of the wheel comes into use from complete lock in one direction to complete lock in the other, the wheel can be shifted round a quarter of a circle when worn, thus giving four separate positions to compensate for wear.

There is a conveniently placed oil filler on the upper part of the steering box, and it is of interest to observe that both the wheel and the worm are of phosphor bronze.

Before leaving this very interesting chassis some particulars of materials used in the construction of the more important parts will be cited, and it will be seen that the quality of the material could not at the present time well be improved, and this will be clear from a perusal of the table that follows:

Name of part	Materials	Ultimate stress. Tons per sq. in.	Elastic limit. Tons per sq. in.
Crankshaft	Nickel chrome steel	50	40
Gear shafts, propeller shaft and axles	Nickel steel	40	22
Gear wheels	Nickel chrome steel	108	102
Front axles	Mild steel	35	24
Stub axles	Mild steel	35	24
Crankshaft bearings	White metal	..	..
Gudgeon pin bushes and bushes generally	Phosphor bronze	..	..
Crankcase and gearbox	96% aluminum	13	
Cylinders	Hard cast iron	..	..
Levers	Mild steel	28	14
Hubs and brake drums	Mild steel	28	19

A bevel drive is used in the new Star back axle and the bevel shaft is supported by large diameter ball journal bearings placed 2 3-4 inches apart. The bevel pinion shaft has a diameter of 1 3-4 inches and it will be seen that there is a small ball journal bearing immediately behind the pinion so that the shaft is well supported. The width of the bevel teeth is 1 1-4 inches, rather a less width perhaps than is usual, but the wheels are both of good diameter. A bevel type of differential gear is employed, the shaft wheels being mounted upon squares. The axles are 1 1-2 inches diamter and do not take any part in supporting the weight of the vehicle, but serve merely as driving shafts. The wheels are mounted upon large ball bearings on the axle tube ends and a detachable wheel is used.

The design of the axle is throughout compact, but there appears to be some degree of unnecessary weight, more especially in connection with the bearing supporting sleeves which fit into

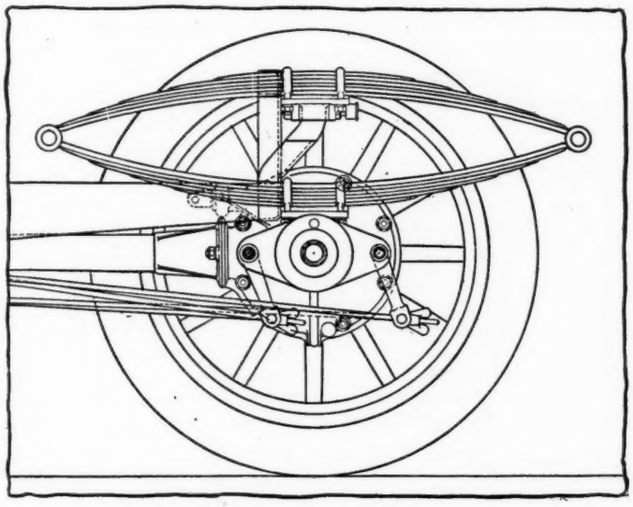


Fig. 5—Arrol-Johnston uses full elliptic rear spring

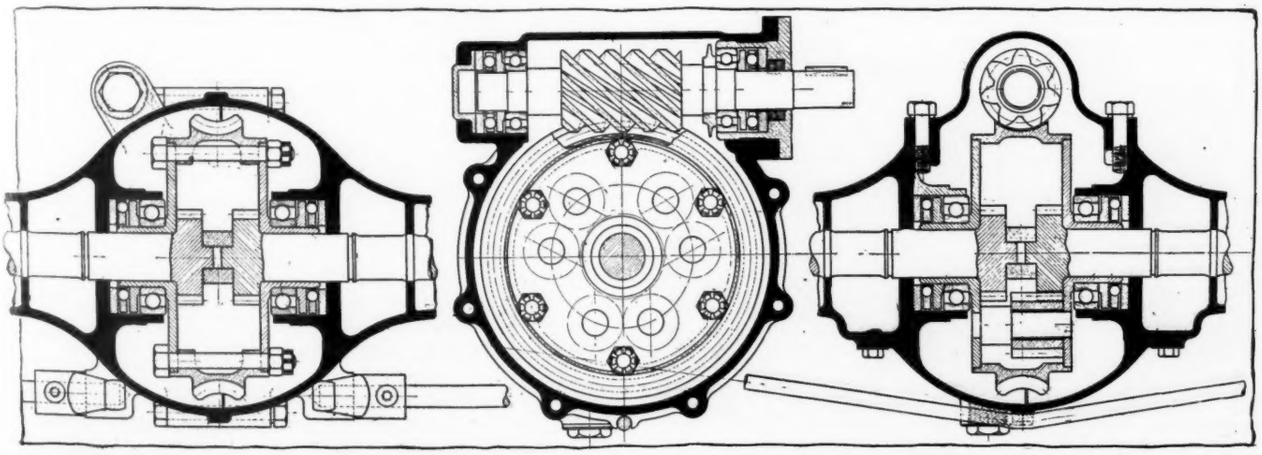


Fig. 6—Belsize worm drive, showing ball-bearing mountings for worm and gear. Left and right views show end and center shows side view

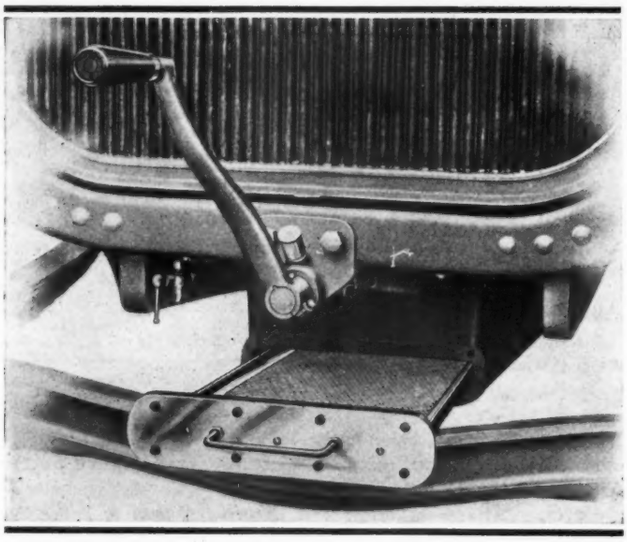


Fig. 7—Removable strainer pan in Vauxhall oiling system

the cast axle tubes. These, it will be noticed, are heavy and might well, one would think, have been made lighter without unduly decreasing strength. The axle tubes themselves, too, are perhaps a little heavy, though when using castings here a good deal of weight is difficult to avoid.

The brake shaft, which is 1 inch in diameter, is well supported by two bearings whose centers are 8 1-2 inches apart and the bearing brackets are strong. The bracket nearest the brake drum nearly always takes the form of a suitably ribbed disk, in some cases slightly dished; thus the chances of a breakage here are not at all considerable.

The Swift rear axle is of the floating type supported on load ball bearings throughout, the bevel pinion being carried on a separate unit bolted to the differential case and can thus be easily dismantled for inspection purposes. The differential case itself is split horizontally, thus insuring oil being retained. The torque of the bevels is taken up by a V torque rod with buffer springs hinging from the forward cross member of the main frame. The frame itself is of pressed steel inswept at front, upswept at rear, the inner folds of the side members being extended and pressed to rectangular section and thus forming an under frame for supporting the engine and gearbox. This is an expensive job but undoubtedly tends to ensure perfect rigidity and alignment. The steering is of the worm and nut type, the box itself being attached to the main frame by a circular flange, provision being made for a varying rake of steering post to be fitted. The springs are semi-elliptical front with three-quarter elliptical rear, the latter taking their support on the spring

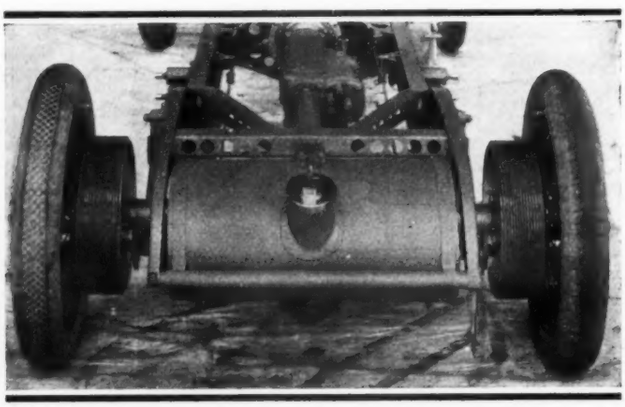


Fig. 9—Tank and brakes on 30-horsepower Sheffield-Simplex

block which swivels on a suitable bearing on the axle sleeve. Detachable road wheels, 760 x 90 millimeters, are fitted. Wheelbase, 9 feet, wheeltrack, 4 feet 3 inches.

The width of the teeth in the Briton bevel rear axle is 38 millimeters and the pinion is cut solid upon its shaft. Here again there is the before-referred-to combination of bearings for the forward end of the pinion shaft is supported in a phosphor bronze bush while at the after end there is a ball journal bearing. This latter bearing appears to be very necessary since the pinion overhangs its journal bearing somewhat owing to the interposition of a ball thrust bearing. The differential gear has bevel wheels and the driving wheels are mounted upon squares upon the axles. At their outer ends the axles have squares to

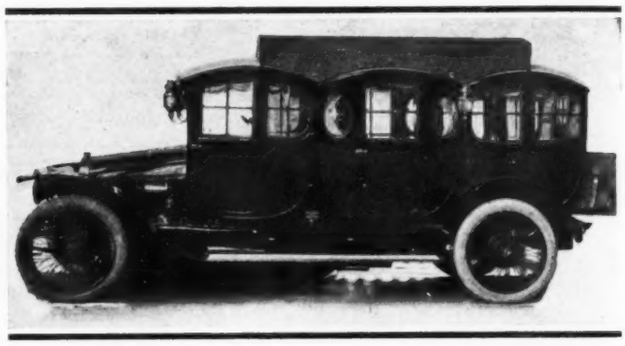


Fig. 8—Gregoire diligence coach seen at Olympia show

drive the wheel hubs and it will be at once noticed that the driving axles have to take the weight of the vehicle as well as the torque. The overhang of wheel to ball journal bearing has been reduced as much as possible in order to keep down the load on the bearing and prevent any possibility of a bending action being set up; thus the distance from center of wheel spoke to center of ball bearing is less than 2 inches.

The chief alterations of the Rolls-Royce cars for 1913 will be the employment of the cantilever type of rear springs and also the employment in place of radius and torque rods of a large spherically ended torque and radius rod of tubular section enclosing the propeller shaft.

Referring to the inverted springs, they are pivotally attached to the side members of the main frame by means of blocks each of which is attached to its spring at the point of maximum bending moment. These blocks engage with pins or shafts integral with or rigidly attached to brackets mounted on the side member of the main frame. The latter may be suitably stiffened at this point by cross members or other means. The front end of each of the springs is supported on the side member of the main frame by means of a link which is pivoted to a bracket formed on or attached to the side member of the main frame. The rear end of each of the springs rests on a roller mounted on a pin carried by a hanging bracket formed on or attached to the rear axle casing. Lateral movement of the springs relatively to the rear axle is prevented either by means of collars formed on the ends of the rollers or by causing the springs to engage with the inside faces of the brackets. A safety stop may be provided to prevent the axle from leaving the frame in the event of the tubular member enclosing the propeller shaft, breaking. The tubular member which is rigidly attached to the axle casing and envelops and encloses the propeller shaft is attached at its forward end to the main frame by means of any suitable form of universal joint, a convenient form of which is spherical and bears upon the outside of a hollow ball which is attached to the main frame either by means of trunnions or in any other suitable manner.

The action of this improved suspension is as follows: The axle casing and propeller shaft casing form a rigid transmission unit which is attached at its front end to the main frame of

the vehicle by a suitable form of universal joint. This arrangement together with the lateral rigidity of the inverted springs constrains the axle to move only in a vertical direction relatively to the frame, said movement being controlled by the vertical resilience of the spring. It further allows either wheel to rise relatively to the other without straining the controlling mechanism in any way.

Last year the Rolls-Royce Company stiffened up the frame of the chassis by introducing tubular cross members, with a view to preventing the twisting of the frame and the setting up of strains in the body. This year the frames will be further stiffened up by the employment of tie rods from end to end. Other lines of improvement consist of a brake adjustment of the road wheel brakes which is now effected by finger nuts instead of spanner as heretofore. Louvres have been introduced into the under-screen so as to carry away the heated air from the engine. Ventilators also have been fitted to the dashboard.

Provision is now made for driving a dynamo for electric lighting by means of a special pulley fixed at the front end of the gear box. The cone clutch has been improved by the use of a special fabric lining on the cone in place of leather as formerly used.

The show indicates more than ever the tendency toward luxuriant body work. Fewer chassis are exhibited, and on many of the leading stands, such as Rolls-Royce and Daimler, no chassis are exhibited, but merely completed carriages. The coach work is very magnificent, and the tendency of design of nearly every type of body is in connection with the stream line order or torpedo shape. Carriages of the limousine and landaulet order like those of the touring types have sweeping scuttles to harmonize with the sloping bonnets, and this with their lowness to the ground, domed roofs, and sloping extensions adds much to their elegance. The cabriolets are becoming more popular, due to the ease and quickness with which they can be converted from entirely closed town carriages into completely open touring cars.

The landaulet type of car is becoming considerably modified. An example of the latest construction of this type is shown in connection with the Delaunay-Belleville body.

This body is of the limousine landaulet type, and while

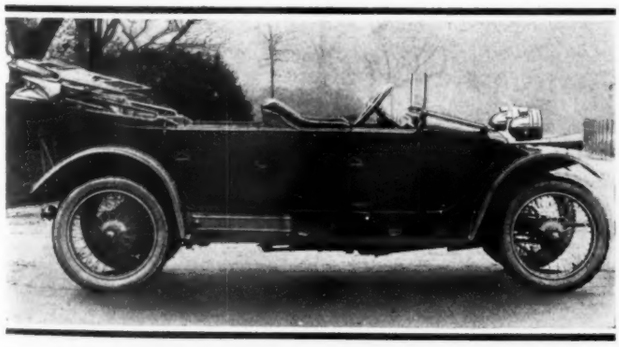


Fig. 10—Lanchester torpedo touring car. Note short bonnet

it has almost the appearance of a limousine it opens out in a similar manner to the older three-quarter landaulet. Several examples of the latest type in body work are illustrated in connection with Napier, Rolls-Royce, Delaunay-Belleville, Sheffield-Simplex, Daimler and other well-known makes. A study of the design of these cars illustrates the fashionable lines now prevailing.

The new special Daimler chassis has been designed to supply the demand for a car of the highest possible grade, and no effort has been spared to make it ideally suited for those who desire the best, irrespective of cost. Throughout the design there is no tendency toward originality for its own sake; the chief features are on the lines proved best by past experience and every minor

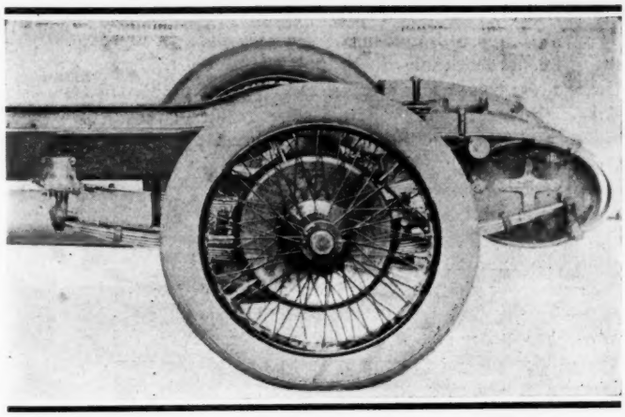


Fig. 11—Daimler gasoline tank swung between rear springs

detail has been perfected for the object for which it is designed.

The chassis has a wheelbase of 11 feet 11 inches, which provides ample accommodation for a body of the largest size. At the same time the steering gear has been so designed that the car can be turned round in a comparatively small circle and hence it is easily handled in traffic. The tread is the standard 4-feet 8.5-inch gauge, and the ground clearance is ample for all requirements, fully 8 inches being available at the lowest point.

Motive power is supplied by a six-cylinder Daimler sleeve valve engine of 101.5 millimeter bore and 140 millimeter stroke. This engine is amply powerful for all work and even in hilly country the car will take full load everywhere on top gear. A high speed average can be maintained without the slightest trouble or inconvenience to the passengers. Various special engine features, such as the offset setting of the cylinders and the arrangement of the carbureter, result in usually good slow running qualities. With full load on board the car will run at a slow walking pace and pick up from this to a speed of 60 miles an hour without any apparent effort or noise.

The transmission components include a leather cone clutch, having special springs beneath the leather to insure smooth starting, a four-speed and reverse gearbox and worm-driven rear axle.

A special feature to which attention may be directed is the withdrawal of the clutch by the side brake so that the clutch shaft and gears may be at rest when the car is standing with the engine running. But, to enable the engine to be used for braking purposes at the same time that the side brake is in operation, there is a second position of the latter lever, which thus has gate control, to secure the desired result.

The springing is a portion of the design which has been very thoroughly tested. The front springs are of the semi-elliptic type, broad and long, fitted with the Daimler swivel shackle at

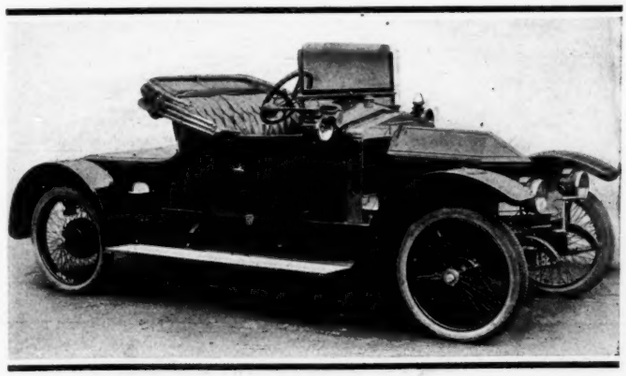


Fig. 12—Deasy two-seated runabout with convertible rear platform

the rear end, to prevent frame distortion. Three-quarter elliptic springs are used at the rear, Fig. 11, and in conjunction with the efficient shock absorbers fitted between the axle and the frame these completely insulate the body from all road shocks.

A high-powered car of this type requires very satisfactory brakes and it will be found that those fitted in the present case are strong enough for all requirements. In addition, they are well supported and easily adjusted, while, in the case of the rear wheel brakes, satisfactory equalizing mechanism is employed.

The Daimler Cranmore is a six-seater landaulet fitted to a 26-horsepower chassis. This body is of the low-built type introduced by the Daimler company, at the last Olympia show, and which has proved so extremely popular during the past year. There is ample room both in front and at the rear for all the passengers, while the seats are broad and thickly cushioned. The coloring is black with fine white lines, and the upholstery is black leather for the front seats, and black morocco with special dark gray cloth and laces inside. The interior decorations are of silver and rosewood.

The Compton six-seater limousine, fitted to a chassis known as the special Daimler, which is fitted to a six-cylinder engine, 101 by 140 millimeters. This carriage is colored gray, with a darker shade for the top quarter. The interior arrangements of this car have been carried out on a luxurious scale.

The Argyll car has a worm-drive back axle. The worm is cylindrical and is mounted over the wheel on a short length of splined shaft. These splined shafts occur frequently in the Argyll chassis and this method of attaching a part of a revolving shaft is undoubtedly a very good one, whether the part in question has to slide or is stationary. Splined shafts are generally considered somewhat expensive and no doubt they require special machinery and well kept cutters for their proper production, but for first class work they form an essential part.

A heavy double ball thrust has a position at the back of the worm as usual and the adjustment for this bearing is a good one, consisting of a nut with holes for turning and a castellated locking cap, the latter being locked in its turn by a steel spring finger piece.

The journal bearings for the worm are 7 inches apart and have balls 9-16 inch in diameter. A bevel type of differential gear is employed, having three planetary wheels. Single ball thrusts occur betwixt the differential casing and the back of the bevels and a small ball thrust collar finds a position where the driving axles would otherwise abut.

The driving axles have a diameter of 1 7-16 inches and are submitted to a torsional strain only, there being no bending action whatever. Once again the spline system is in use in connection with the driving of the permanent hub. The journal bearings of the road wheels are spaced 3 1-4 inches apart and are well protected from road dust by a packing groove. The plate casting which protects the brakes and holds the brake shaft and fulcrum pin has an annular recess cast upon its interior face to catch any oil, and thus to prevent any detrimental lubrication of the braking surfaces.

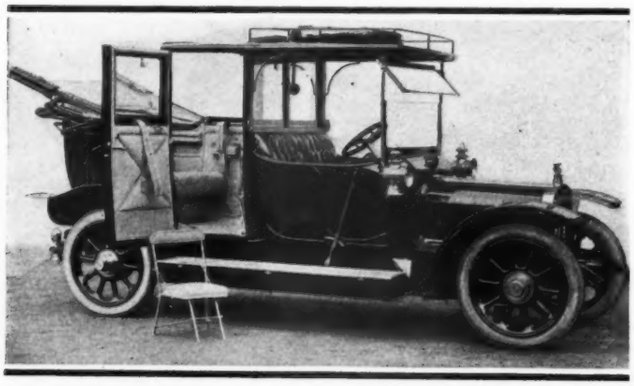


Fig. 13—Austin landaulet with auxiliary chair upholstered to match trimming

At the inner end of the axles, outside the ball-thrust bearings, spring held disks are provided to prevent the escape of oil from the axle casing and in addition there are screw stuffing boxes with locked glands, so that even after a long period of time there should be very little loss of oil; thus adequate lubrication of the worm and its wheel is particularly well looked after.

A great amount of thought and consideration has been given to the design of the 38.4-horsepower, six-cylinder Napier royal saloon carriage, by the Cunard Motor & Carriage Company.

The body takes the form of a wholly inclosed car, with a glass division separating the driver's compartment from the main portion, with three entrance doors, and three windows in the body besides those in the doors, a wind-cutting glass screen over a deep scuttle extension of the dashboard and a roof with edges blended into the sides and back of the body.

Throughout the car, the predominant feature is the grace of the curves which harmonize one with the other wherever their outlines meet. The car is low and sleek in appearance, and appeals to one's sense of swiftness and elegance. The height inside, however, is ample for tall persons, and ladies with high hats will find that their convenience has been amply studied and the necessary head-room given.

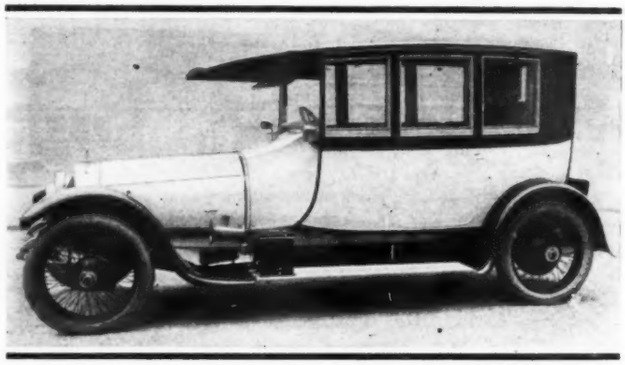


Fig. 14—Exhibition model of 30-horsepower Sheffield-Simplex berline

With regard to details, the four passengers in the rear interior are carried two on the main seat and two on folding seats with back rests, which latter are designed for comfort. Access to this part of the car is by a very wide door on either side. The driver's compartment is entered by a door on the near side and to give easy access to his seat; the passengers' seat is made to tilt up like a theater stall. This method of construction does not interfere in any degree with comfort, and arm rests are provided. The division at back of driver's seat consists of two windows arranged to lower, and at his side the window comprises two pieces of glass divided vertically one to slide over the other. Throughout the car the windows are frameless, of best plate glass, and those arranged to drop have new patent lifters which easily and securely fix them in any desired position and obviate the use of the usually awkward strap.

The windscreen in front of driver, carried on a deep extension rearwards of the dashboard is a V-shaped wind deflecting type which was introduced on the six-cylinder Napier car that gained the Grand Prix award at the Turin Exhibition. It has been improved since, and the rearmost vertical frame brought well back so that nothing now obstructs the line of vision of the driver. Each frame of the V contains two glasses, the lower of which is fixed and the upper adjustable outwards to any angle—each window independently of the other.

Aluminum is used almost wholly throughout the construction of this body and every curved panel has been beaten to shape by hand. The decoration of the interior has been carried out to combine utilitarian purposes with artistic effect; inlaid satinwood has therefore been chosen, and the roof, sides, doors

and heelboards are comprised in the scheme. Exquisitely figured panels and plain panels with sections set out with the grain at varying angles add to the beauty. The upholstery is in cream morocco, and four electric lamps on projecting brackets are fitted with shades of floral design. Metal interior fittings with their delicate tracery in silver and dull gilt impart an air of refinement. Every point that the most fastitious could demand has been studied, even to regulating the temperature of the interior, and a ventilator is fitted in the roof with its opening adjustable at the will of the occupants by a very ingenious cylinder and piston device. A Hall flap is also provided to enable the passengers to communicate with the driver.

The finish of the exterior is a tasteful shade of cream with black, the panels and bonnet being in the former color, while the roof and wings are black. The combination, notwithstanding its contrast, is particularly pleasing and harmonious.

The chassis has Rudge-Whitworth detachable wire wheels with

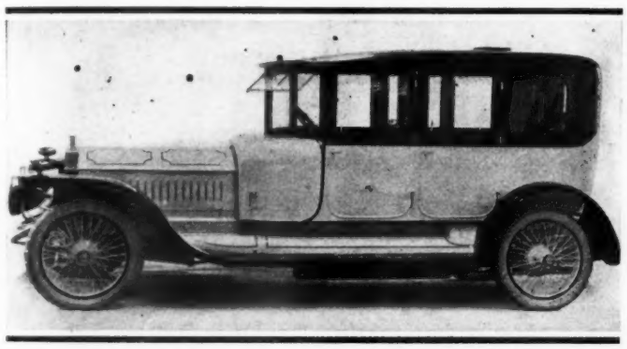


Fig. 15—Special six-cylinder Napier exhibited at Olympia show

895 by 135 millimeter tires all round, and the new wheelbase is 11 feet 6 inches.

In the British high-price car the accessories are exceptionally well taken care of. Electric lighting is fitted to all the makes and ornamental features instead of being treated as extras are fitted as a matter of course and the parts of the car that they are attached to take the fittings in a rigid and substantial manner. This is especially true in the matter of the top. This is generally designed to swing back of the body, as in Fig. 16.

Figs. 15 and 16 show the clear running boards and side members. Nothing is permitted to mar the elegant appearance of the straight-line body. Tools, tires andother impedimenta are kept away from the body of the car and are placed to the rear of the chassis or beneath the passengers' and driver's seats.

Harking Back a Decade

FROM *The Automobile and Motor Review*, November 22, 1902: The new type of electric delivery wagon being put out by the Vehicle Equipment Company carries 1 ton of freight and averages about 50 miles a day. This extraordinary mileage is accomplished by recharging the partially discharged batteries during the noon hour.

Applicants for space at the Madison Square Garden Show are still swamping the managers of that exhibition. The allotments have been made and save for a change here and there, the late applicants will have small chance to secure space. The show will be held January 17-24. The annual banquet of the N. A. A. M. will be held January 21.

The worm has apparently turned. Theodore Havemeyer, an automobile owner of Brooklyn, has instituted suit for damages against Charles Hart, a contractor, alleging that through the defendant's negligence in leaving an excavation unprotected, into which Havemeyer's car plunged, injuring four persons. Litigation of the past has been practically unanimously against the automo-

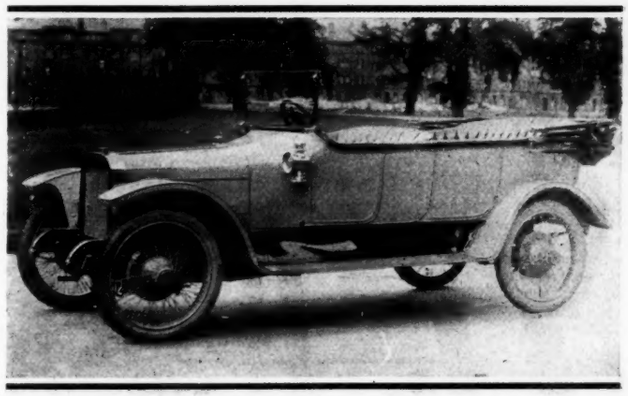


Fig. 16—Argyll 15-30 model made specially for Olympia exhibition

bile owner and the outcome of the present suit will be watched with interest.

Alexandre Ular has discovered, in an article published by *L'Auto Velo*, of Paris, that the Chinese had mechanical vehicles 1,600 years ago and used them extensively. In northern Mongolia he found two huge locomotives employed in drawing gold ore over the highways. The wheels of these machines are 7.5 feet in diameter. Mr. Ular proposes to make the trip from Pekin to Paris with a machine similar to these locomotives, which the reader is made to infer are relics of the antique automobilism of the Celestial Empire.

If any proofs be needed that the present limit of speed for motor vehicles is far below all reasonable requirements of safety, it may be found in the record of the Reliability Run, in which, counting the convoying vehicles as well as those competing, upward of 100 cars traveled a distance of 500 miles each without an accident to an outsider, much less to the riders.

No hill-climbing contest of real importance has yet been held in this country. The nearest approach to a national event was the climb of Nelson Hill last year, but blockades of the road were so frequent during the running that the results were deprived of comparative value.—Editorial.

Eagle Rock Hill in New Jersey has been selected as the course for the Thanksgiving Day hill climb, November 27. The hill is 1 1-8 miles and has an average grade of 14 1-2 per cent. There are a number of severe bends in the road. The early entries for the contest indicate that all the events will be well filled.

The Automobile Club of America now has 392 members, according to the annual report submitted by Secretary Samuel M. Butler.

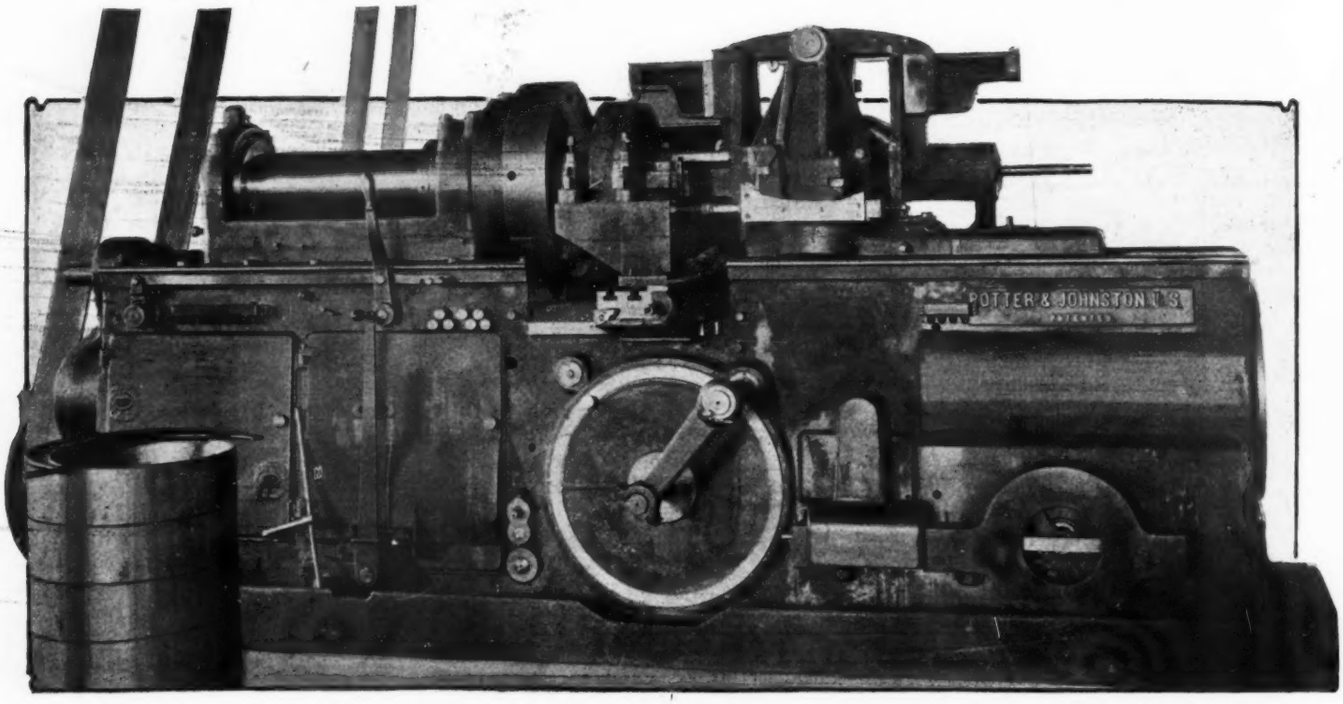
Henry Fournier has lowered W. K. Vanderbilt's world's record for the flying kilometer and Augieres has set a new mark for the flying mile. The cars used in each case by the record breakers were of Mors manufacture as was also that of Vanderbilt. Fournier's time for the kilometer was 29 1-5 seconds and that of Augieres for the mile was 46 seconds flat.

According to the estimates compiled by Winthrop E. Scarritt, president of the A. A. A., the 1903 production of automobiles in America will be 35,000. He predicts that there will be 50,000 buyers who will try to supply their requirements. He does not say how the overplus of 15,000 customers are going to ride next year.

Barney Oldfield, who set fast marks for the mile and 5-mile distances in a Ford-Cooper racer at Detroit, never drove a car until 10 days before the race trials.

Directors of the A. A. A. have decided to give their support to the project of promoting a national highway from coast to coast. General Nelson A. Miles proposed the road and several bills to secure national co-operation have been presented to Congress. The A. A. A. has determined that none of the bills incorporates exactly the right features and is preparing to draught a bill on its own initiative.

Factory Miscellany



Special Automatic lathe used in the factory of the Moline Automobile Company, East Moline, Ill., for turning down flywheels

MOLINE flywheels are turned down by the special machine shown above after they have been roughly cast. This is an automatic machine in that it requires no one to turn a turret or to reset the machine after every operation. It is only necessary to feed the unfinished flywheels. It takes one man only to do the work, and his duties are merely to keep the machine supplied with work and to see that the belting and lubrication of the machine are as they should be. It requires 1 hour and 10 minutes for the machine to finish one casting. This consists of grooving out of the oil ring and turning out the seating for the cone clutch. During the course of a working day the machine can turn out nine finished flywheels and the time required in changing over from the finished job to the commencement of the next is only 4 minutes. The work of changing consists in taking out the finished flywheel by simply pushing back on a lever, slipping in the new wheel and again starting the machine.

MOLINE FACTORIES BUSY—Moline, Ill., manufacturers of automobiles, Moline, Velie and Midland, will be up and doing during the coming year. During the past season 3182 machines have been built and marketed by the three local factories. Plans for 1913 are for the building of 5,900 cars, nearly twice the output of last year. During the coming year 3,500 Velie automobiles and trucks are to be put on the market, while 1,400 Midland cars are planned for next year. The Moline Automobile Company built 782 machines this year and will raise the mark to 1,000 during 1913.

Large Addition Necessary—The Belle City Brass & Iron Company, of Racine, Wis., has commenced work on a large addition which is made necessary by the tremendous rush of orders. All departments are working over capacity and overtime.

Doubles Capacity—The Racine File Company, Racine, Wis., has doubled its capacity and changed its factory drive to electricity throughout. Much new equipment has been added. The company does a large business with motor car and parts manufacturers.

Robinson Adds Truck—The Robinson Motor Truck Company, Minneapolis, Minn., has added a new model to its line called the Minneapolis, a four-cycle truck. The company will continue to make the Gopher, a two-cycle car. The new machine runs in 1 1-2, 2 and 3-ton capacities. The list price of the chassis is $2,500.

Buick Plant Inspected—With Michigan's new compensation law in effect, the Buick Motor Company, Flint, Mich., is setting about the organization of a vigilance committee to make the rounds of the entire factory with the idea of recommending changes which will end to reduce the danger of accident to a minimum.

Chatham Accessory Factory—Work will be started soon on the transformation of the Nellis building, Main street, Chatham, N. Y., from a garage into a factory for the manufacture of automobile parts. A third story may be added or the present building may be raised and a three-story brick structure erected in its place.

Building in Toledo—The last of five new buildings to be erected on Madison avenue, Toledo, O., for the sale of automobiles and automobile accessories is that of the Six Realty Company, which will extend the Madison avenue Auto Row westward. The five structures are either under way at the present time or are in the hands of architects.

Kelsey's Memphis Plant—The Kelsey Wheel Company, Detroit, Mich., will operate at Memphis, Tenn., a plant to manufacture automobile spokes and rims. Two buildings have already been completed of the three proposed. The plant will have a daily capacity of 25,000 spokes and 4,000 rims and machinery will be installed to cost $12,000.

Takes Over Patent Rights—The Columbus Auto Parts Company, Columbus, Ohio, a new corporation recently chartered with a capital of $25,000 has taken over the patent rights and plant of the Columbus Auto Parts & Machine Company. The concern now occupies a large new plant at Russell and Fourth streets, which contains 16,000 square feet of floor space. The company manufactures the Columbus Friction windshield exclusively and is very busy on large contracts to supply automobile factories. C. J. Krag is president; C. M. Klages, vice-president, and R. E. Klages, secretary-treasurer.

Moon Making Improvements—The Moon Motor Car Company, St. Louis, Mo., plans to make further improvements to its plant.

Ford's $250,000 Plant—The Ford Motor Car Company, Detroit, Mich., has given a contract for a six-story assembling plant, in Minneapolis, Minn., to cost $250,000.

Rex Plant in Nashville—The Rex Chemical Company, Newport, Ky., will establish a factory in Nashville, Tenn. The company will manufacture polish for automobiles.

Rubber Company's Addition—Work was recently started on a two-story brick and steel factory addition, for the Portage Rubber Company, Barberton, O., to cost $15,000.

New Plant at Dunkirk—Work was started recently on the Niagara Gasoline Motor Company's Building, Dunkirk, N. Y. The building will be under cover before winter sets in.

Marathon Doubles Capacity—The Marathon Motor Company, Nashville, Tenn., which has been making thirty cars a week, is to install equipment which will double the capacity of its factory.

Larger Tire Plant—The Automobile Tire Repair and Supply Company, Philadelphia, Pa., has leased the building formerly occupied by the Auto Equipment Company in that city, and is using it for a vulcanizing and solid tire plant.

Purchases Atlas Works—J. W. Lyons, who recently purchased the Atlas Engine Works and a plant covering 65 acres at Indianapolis, Ind., has engaged J. Haltenberger, an automobile engineer, to keep pace with the foreign experiments, which are being carried on by C. K. Knight at Coventry, Eng.

Firestone's Frisco Building—Work is now under way on a new building for the Firestone Tire & Rubber Company in San Francisco, Cal. It will be at Van Ness avenue and Austin avenue, with a frontage of 70 feet on Van Ness and 319 feet on Bush street. The structure will be two stories in height.

Negotiates New Scale—A representative of the Carriage, Wagon and Automobile Workers' organization has been successful in executing a new agreement in Sacramento, Cal., whereby the carriage blacksmiths, trimmers, wood carvers and painters will receive hereafter a substantial increase over the wages received heretofore.

Whitesides Starts Factory—Colonel V. F. Whitesides has severed his connection with the Whitesides Commercial Car Company, Newcastle, Ind., with which he has been associated for 4 years in the capacity of designer and factory superintendent. His intention is to come to Indianapolis, Ind., to build a truck to be known as the Ironsides.

Kline's New Plant Opened—The Kline Motor Car Corporation, Richmond, Va., has opened its new factory in that city, where on a 15-acre tract the corporation has erected a modern plant at a cost of more than $100,000. The new factory will have a capacity of 2,000 cars a year. When operated in full on one shift the plant will employ upwards of 750 men.

Shows, Conventions, Etc.

Jan. 2-10	New York City, Importers' Salon, Hotel Astor, Importers' Automobile Alliance.
Jan. 4-11	Cleveland, O., Annual Automobile Show.
Jan. 4-11	Montreal, Que., Montreal Motor Show, Drill Hall and 65th Regiment Armory.
Jan. 11-18	Milwaukee, Wis., Annual Show, Auditorium, Milwaukee Automobile Dealers' Association.
Jan. 11-25	New York City, Thirteenth Annual Show, Madison Square Garden and Grand Central Palace, Automobile Board of Trade.
Jan. 20-25	Philadelphia, Pa., Annual Automobile Show.
Jan. 21-26	Toledo, O., Annual Show, Exposition Building, Toledo Automobile Shows Company.
Jan. 22-25	Geneva, N. Y., Annual Automobile Show.
Jan. 25-Feb. 1	Montreal, Que., Automobile Exhibition, R. M. Jaffray, Manager.
Jan. 27-Feb. 1	Buffalo, N. Y., Annual Automobile Show.
Jan. 27-Feb. 1	Detroit, Mich., Annual Automobile Show.
Jan. 27 Feb. 1	Ottawa, Ont., Ottawa Motor Show, Howick Hall, Louis Blumenstein.
Jan. 27-Feb. 1	Scranton, Pa., Annual Automobile Show, Hugh B. Andrews.
Jan. 30-Feb. 1	Canandaigua, N. Y., Annual Automobile Show.
Feb. 1-8	Chicago, Ill., Annual Automobile Show.
Feb. 10-15	Chicago, Ill., Truck Show.
Feb. 10-15	Minneapolis, Minn., Annual Automobile Show.
Feb. 11-15	Ottawa, Ont., Annual Automobile Show.
Feb. 12-15	Geneva, N. Y., Automobile Show, Armory, Louis Blumenstein.
Feb. 15-22	Newark, N. J., Annual Automobile Show, First Regiment Armory, New Jersey Automobile Exhibition Company.
Feb. 17-22	Kansas City, Kan., Annual Automobile Show.
Feb. 20-22	Canandaigua, N. Y., Automobile Show, Louis Blumenstein.
Feb. 24-Mar. 1	Cincinnati, O., Annual Show, Music Hall, Cincinnati Automobile Dealers' Association.
Feb. 24-Mar. 1	Omaha, Neb., Annual Automobile Show.
Feb. 24-Mar. 1	Paterson, N. J., Annual Show, Paterson Automobile Trade Association.
March 3-8	Pittsburgh, Pa., Annual Automobile Show.
March 8-15	Boston, Mass., Annual Automobile Show.
March 19-26	Boston, Mass., Annual Truck Show.
March 24-29	Indianapolis, Ind., Annual Automobile Show.

Race Meets, Runs, Hill Climbs, Etc.

Nov. 29-30	Richmond, Va., Track Races, State Fair Grounds, Richmond Automobile Club.
Dec. 4-6	Tacoma, Wash., Meeting of Washington State Good Roads Association.
May 30	Indianapolis, Ind., 500-Mile Race, Speedway.

Proposed Contests

Nov. 28-29	Track, Richmond, Va., Richmond Automobile Club.
Nov. 28	Road Race, Visalia, Cal., W. H. Lipton.

View of the factory of the Argyll Motors at Alexandria, Dumbartonshire, Scotland

Fleet of twenty Waverley electric light delivery wagons employed in the service of the Fleischmann Yeast Company of New York

CUTTING Launches Six—The Cutting Motor Car Company, Jackson, Mich., will soon be ready to announce the launching of a six, the first car of this type the Jackson factory has put on the market.

Prendergast Sales Manager—F. N. Prendergast has begun his duties as manager of the local branch of the Foss-Hughes Company, Washington, Pa.

Doubles Garage Capacity—W. S. Sandman, Cambridge, Mass., has doubled the floor space of his fireproof building. The garage now has a total floor space of over 7000 square feet.

Nelson Consulting Engineer—E. A. Nelson, the chief engineer of the Hupp Motor Car Company, has given up the active duties of that office and assumed the title of consulting engineer.

Hess Resigns—H. Hess has resigned as president of the Hess-Bright Manufacturing Company, Philadelphia, Pa., and has sold all of his holdings in that company. It is understood that no change in the policies of the company is contemplated.

Thomson Dixon Manager—A. G. Thomson has been made sales manager for the Joseph Dixon Crucible Company, Jersey City, N. J. He will represent the automobile department of that company.

Organizes Sales Company—J. G. Wolleager, Milwaukee, Wis., has organized the Molleager Sales Company to continue the business of the Milwaukee branch of the Studebaker Corporation of Milwaukee.

Robartes Represents Locomobile—F. W. Robartes has located in Washington, D. C., as resident manager of the Washington branch of the Locomobile Company of America, Bridgeport, Conn., with headquarters at 1124 Connecticut avenue.

Kissel Kar Station Finished—The new Boston, Mass., Kissel Kar station has been completed, adding one more to the chain of service buildings which are being erected throughout the country for the patrons of the Kissel Motor Car Company, Hartford, Wis.

Farmers Use Trucks—Farmers in California are using trucks to great advantage. On the ranch the truck is being used with a profit that cannot be surpassed in any other business. The Kissel Motor Car Company, Hartford, Wis., is busy filling orders for trucks from that state.

Must Stand Police Trial—A new police regulation was put into effect recently in Washington, D. C., whereby motorists and drivers of other vehicles who violate the speed and traffic regulations at the intersection of streets will not be allowed to forfeit collateral, but will be obliged to stand trial in the police court.

Recommends Automobile Apparatus—In a report covering a survey of the fire-fighting facilities of Indianapolis, Ind., the National Board of Fire Underwriters has recommended that all new apparatus bought for the department and all apparatus of companies making long runs on the first alarm shall be motor apparatus.

Automobiles in Venezuela—Automobiles are to be used in transporting passengers and freight around the rapids in the upper Orinoco River, Venezuela. The Venezuelan government has pledged a subsidy of $3,860 to the new automobile service, which will make better time possible on shipments from the rubber district via the Orinoco.

Birmingham's Speedway—Birmingham, Ala., is to have a $160,000 speedway modeled after the course at Indianapolis, Ind. This announcement was made by the directors of the Edgewood club recently. The movement is being supported by the Board of Commerce. It is planned to make Birmingham the center of winter racing in the South.

Investigating Maryland Arrests—The Washington, D. C., Chamber of Commerce has appointed a special committee to investigate the charges made to that body that Maryland constables are making unwarranted arrests of Washington motorists, and that the Maryland laws relating to automobile licenses are discriminatory against the District.

Taft Considers Road Plan—President W. H. Taft has taken under consideration a plan launched by Senator Martin and Representative Carlin for the expenditure of the $500,000 recently appropriated by Congress for good roads experiments on a model boulevard to be constructed from Alexandria, Va., to Mount Vernon, the tomb of Washington.

Regulations Extended—The regulations issued by the treasury department at Washington, D. C., on March 28, 1911, providing for the allowances of drawback on motor car top rubberized fabric, manufactured by the Archer Rubber Company, of Milford, Mass., with the use of imported mohair cloth and cotton mohair cloth, have been extended to cover motor car covering cloth manufactured by the International Rubber Company, of New York.

Locomobile Truck's Efficiency—Motor truck efficiency was recently shown by a Locomobile 5-ton truck, a product of the Locomobile Company of America, Bridgeport, Conn., which was working on a construction contract at Woodbridge, Conn. In order to facilitate the transportation of the different materials, a trailer of special design was built for them. This truck made several trips each day, over very rough roads, averaging over 10 tons to each load.

New Agencies Established During the Week

PLEASURE CARS

Place	Car	Agent
Anderson, Ind.	Cole	Anderson Auto Co.
Baxter, Ia.	Cole	Hager Bros.
Bayonne, N. J.	Cole	W. H. Dykeman
Beloit, Wis.	Abbott	L. Allen Co.
Blue Springs, Neb.	Cole	A. H. Krauss & Co.
Brainerd, Minn.	Luverne	J. Flanagan
Burlington, Vt.	Cole	Churchill & Lockwood
Cairo, Ill.	Cole	R. L. Hosmer & Co.
Canton, O.	Cole	E. J. Quigley
Canton, Ill.	Cole	G. Coleman
Cedar Bluffs, Neb.	Cole	Ostrand & Lampert
Charleston, W. Va.	Cole	J. R. King
Clarksburg, W. Va.	Cole	C. S. Thompson
Clarksdale, Miss.	Cole	W. E. Campbell
Clio, S. C.	Cole	Covington & Smith
Columbus, Neb.	Cole	A. J. Dischner
Columbus, O.	Cole	Franklin Cycle & Supply Co.
Cortland, N. Y.	Cole	Letts & Farrell Co.
Darlington, Wis.	Abbott	A. C. Poole
Fort Smith, Ark.	Cole	Boehmer & Sheridan
Fremont, O.	Cole	J. R. Kiser
Grand Forks, N. D.	Luverne	Dakota Auto Co.
Grand Rapids, Wis.	Oakland	Jenkins Bros. Co.
Greenwood, Miss.	Cole	W. S. Wright
Helena, Ark.	Cole	B. L. Lyford
Howard, S. D.	Luverne	D. A. McCullough
Hudson, Wis.	Ford	Hudson Gar. Co.
Hudson, Wis.	Overland	Hudson Gar. Co.
Itta Bena, Miss.	Cole	Townsend & King
Janesville, Wis.	Chevrolet	Janesville Auto Co.
Janesville, Wis.	Herreshoff	Janesville Auto Co.
Johnstown, Miss.	Cole	L. F. Weathersby
Kellogg, Ia.	Cole	Craven & Hoberly Co.
Knoxville, Ia.	Cole	L. L. Bybee & Co.
La Crosse, Wis.	Cole	Elsen & Phillips
Lebanon, Ind.	Cole	Lofland & Layton
Lexington, Miss.	Cole	E. Norquist
Louisville, Ky.	Cole	Mille Auto Co.
Macon, Mo.	Moon	Macon Gar. Co.
Madison, Wis.	Cutting	Albrecht M. Sales Co.
Madison, Wis.	Herreshoff	Albrecht M. Sales Co.
Madison, Wis.	Little	Albrecht M. Sales Co.
Marion, Ind.	Cole	W. Hillsamer & Son
Marshall, Mo.	Cole	Tipping Bros.
Marshalltown, Ia.	Cole	J. H. Fisher
Mason City, Ia.	Cole	Clover Leaf Co.
Mauston, Wis.	Oakland	C. L. Sharp
Wheeling, W. Va.	Cole	A. W. Lee
Meridian, Miss.	Cole	E. S. Curtis
Meridi, Yucatan, Mexico.	Cole	W. M. James
Mobile, Ala.	Cole	Bloch Bros.
Moro, Ore.	Cole	W. H. Moore & Co.
Mt. Pleasant, Tenn.	Cole	J. M. Granberry
New Haven, Conn.	Cole	The Knight Garage
New Haven, Conn.	Moon	J. J. Laverty
New London, Conn.	Cole	Lathrop & Smith
North Yakima, Wash.	Luverne	E. M. Ernsdorff
Oakland, Miss.	Cole	Crow & Marder
Oblong, Ill.	Cole	Oblong Auto Co.
Oil City, Pa.	Cole	C. H. Weaver
Oklahoma City, Okla.	Cole	Oklahoma Motor Car Co.
Portage, Wis.	Cole	A. R. Slinger
Portland, Ore.	Luverne	G. A. Lovejoy
Providence, R. I.	Cole	Pawtucket Auto Co.
Racine, Wis.	Ford	Gunther & Laux
Rock Island, Ill.	Cole	Treror & Snyder
Rosenburg, Tex.	Moon	Rosenberg M. C. Co.
Schaller, Ia.	Moon	E. F. F. Hasseler
Scranton, Pa.	Cole	H. S. Smith
Sharon, Wis.	Little	Anderson Auto Co.
Shreveport, La.	Cole	M. Nulsen
St. Louis, Mo.	Cole	Bagnell Auto Co.
St. Marys, W. Va.	Cole	R. W. Russell
St. Paul, Minn.	Luverne	A. G. Bauer Auto Co.
Summerville, Tenn.	Cole	C. A. Oliver
Tarboro, N. C.	Cole	J. B. Pennington & Co.
Taylor, Tex.	Moon	Prewitt Auto Co.
The Dallest, Ore.	Cole	J. B. Kirk
Van Meter, Ia.	Cole	H. V. Van Meter
Winfield, Ia.	Moon	Nesbitt Auto & Sup. Co.
Worcester, Mass.	Cole	Palace Auto Station
Yankton, S. D.	Luverne	Todt Bros.
Ypsilanti, Mich.	Cole	Cary S. Davis

Klinger Chief Engineer—P. W. Klinger, who has served the Speedwell Motor Car Company, Dayton, O., in the capacity of factory manager, has recently assumed the title of chief engineer.

A. J. Hoskin, the late Western editor of *Mines and Minerals,* has resumed private engineering practice in Denver, following the closing of the Western office of the journal with which he had been connected.

Oconto Falls Garage—The Oconto Falls Motor Car Company, Oconto Falls, Wis., distributers of Overland and Ford cars, is building a $10,000 garage to be equipped with machinery driven by electric power.

Reeves in Columbus—Two well-known automobile men were in Columbus, O., during the past week, Alfred Reeves, general manager for the United States Motor Car Company, and J. I. McCloud, central supervisor for the same company. While in the city they visited the local agency.

Cobb Succeeds Luce—A. M. Cobb has been named to succeed Norton H. Luce, resigned, as manager of the Velie Chicago, Ill., branch at 1615 Michigan avenue. Mr. Luce goes to New York City in charge of eastern sales for the Marion Motor Car Company of Indianapolis. He is at present candidate for treasurer of the Chicago Motor Club.

Traveler Company Organized—The Traveler Motor Car Company, Detroit, Mich., is one of the latest companies to be organized in that city. It will issue a four-cylinder car fully equipped to list at $950. The Lavigne Manufacturing Company, Detroit, Mich., is behind the new company, which will manufacture the cars in the plant of that company.

Repair People Combine—The announcement is made that the Auto Exchange, at Park and Goodale streets, and the Columbus Auto Inn, at Sixth avenue and High street, Columbus, O., have united and located at the latter place. A large repair department and paint shop has been opened and general garage work will be done. R. C. Shisler and M. E. Bedlack are the managers of the merged concern.

Indiana Road Convention—The program for the Indiana Better Roads Convention, Indianapolis, Ind., is rapidly nearing completion. The convention will be held December 11 to 13. The principal purpose of the convention will be to discuss bills for better roads, to be introduced in the State Legislature when it meets in January. One of the proposed bills probably will provide for a state highway commission.

Licensed Chauffeurs Increase—There has been an increase of 2,750 in the number of licensed automobile chauffeurs in Ohio within the past two years. In 1910 there was a total of 5,135. Last year the number was 6,402, which was at that time equal to any other state in the Union. But this year, with 30 days more before the records are closed, the number aggregates 7,885, and nets the state the sum of $15,770. The fiscal year ends on December 15, and it is expected that before that time the total number of licensed chauffeurs will exceed 7,900.

Akron Gets Apparatus—Bids were opened last week by Safety Director Dan P. Stein, Akron, O., for seven pieces of motor-propelled fire apparatus as follows: Tractor, Nott Fire Engine Company, $4,250; combination truck, Webb Motor Apparatus Company, unequipped, $5,072.50, equipped $5,400; 85 ft. aerial truck, unequipped, $10,509.75, equipped $11,300, Webb Motor Apparatus Company; combination hose wagon, Lange Motor Truck Company, $4,152.20; three combination pumping engines, Webb Motor Apparatus Company, unequipped, $7,915.80, equipped, $8,200.

New building of the Longstreth Motor Car Company, Philadelphia, Pa. The structure is of concrete with a terra cotta front. It occupies a space 65 by 125 feet and has a total floorspace of 24,375 square feet. The Longstreth company handles the Alco in Philadelphia and vicinity

Special type truck body built for J. S. Brown & Brother Mercantile Company, Denver, Col., by the Packard Motor Car Company, Detroit, Mich. Detached bodies may be rolled on channel irons in the truck platform.

Bartlett with Universal—L. A. Bartlett has become identified with the Universal Motor Truck Company, Chicago, Ill.

Mr. Frank C. Bowman, of Denver, is in charge of the metallurgical work of the New Reliance Company in the Black Hills of South Dakota.

Bonnell Manager Mitchell—H. W. Bonnell has been appointed manager of the Milwaukee, Wis., branch of the Mitchell Automobile Company.

Gregg with Michigan—E. E. Gregg has been appointed assistant sales manager of the Michigan motor branch with headquarters at Pittsburgh, Pa.

Stryker's New Position—A. M. Stryker has joined The Stewart & Clark Manufacturing Company, Chicago, Ill. He is in charge of the advertising.

Rushmore Resigns—George D. Rushmore has resigned as sales manager for Neate & McCarthy, Portland, Ore., and has been succeeded by Harry Twitchell.

Roberts with Maxim—C. W. Maxim, manager of the Middleboro Automobile Exchange, Middleboro, Mass., has appointed L. H. Roberts as director of wholesale sales.

Huntington Leases Garage—Guy E. Huntington of Pulaski, Wis., has leased the Elert-Barton building at Owen, Wis., and will open it as a garage and salesroom on December 15.

Uruguay Postpones Competition—Due to unavoidable delays it has been necessary for Uruguay to postpone the International Competition of Agricultural Motor Vehicles until March 31, 1913.

Milwaukee Watching Delinquents—The Milwaukee, Wis., fire department is keeping a close watch on garages to discover violations of the city ordinance regulating the storage of gasoline and oils.

Will Make Ignition Apparatus—Edward S. Jacobson, Floyd A. Knight and John J. Whittlesey have formed the J. & B. Company at Pittsfield, Mass., to make ignition and other motor accessory appliances.

Langley Sales Manager—Replacing Britt Webb, who is now in charge of the Buick branch house at San Antonio, Tex., R. C. Langley is acting sales manager for the Buick Company at its Dallas branch.

Wolfe Resigns—M. C. Wolfe, for several years manager of the Columbia division of the United Motor Company, Dallas, Tex., has resigned to become manager for the Southwest of the KisselKar Company.

Is Manager—C. A. H. de Saulles has taken the managership of the United States Zinc Company, at Pueblo, Colo. Mr. De Saulles has been at Gas, Kan., for some time, managing the smelter of the Prime Western Spelter Company.

Puerner Sells Garage—A. E. Puerner has sold his garage and agency business at Fort Atkinson, Wis., to the Hofmeister Motor Company of Watertown, Wis., which will conduct it as a branch. Mr. Puerner retires because of ill health.

Alabama Registration Increased—An increase of 30 per cent. in the amount of license money paid into the Alabama treasury by automobile owners has been registered this year. The entire amount realized this year is slightly in excess of $40,000.

Toledo Falls in Line—Safety Director J. J. Mooney has requested the Council to authorize the motorizing of the Toledo, O., fire department, and that body now has the matter under advisement. The cost of the undertaking is estimated at $185,000.

Wants New Ordinance—Mayor S. L. Shank, Indianapolis, Ind., has asked the city legal department to prepare an ordinance forbidding automobiles to go around street cars on the left-hand side, when the street cars are stopping to receive or discharge passengers.

Automobile Bus Line—An automobile bus line is to be established between Louisville, Ky., and Richmond, Va. The Citizens' Motor Car Company is to operate the line, which, it is stated, will be in operation as soon as the equipment is received there from Cincinnati, O.

Installs Improvements—The Prange Garage Company of Sheboygan, Wis., has completed important improvements to its garage building, including the installation of more commodious offices, stock and store rooms, enlargement of the repair department and general renovation.

Library Uses Automobile—The Delaware State Library Commission is using an automobile to handle its traveling library in Kent County, Del., and finds that the results are excellent and the cost no greater than would be the case with a horse and wagon, which plan is followed in some other parts of the state.

Federal for Frisco—A Federal chassis equipped with a spacious body is now used in San Francisco, Cal., to carry stray dogs to the city pound. It has been in operation for six months, averages 1,000 miles per month at a cost of $1 a day. The wagon is operated by the Society for the Prevention of Cruelty to Animals.

Milwaukee's Automobile Funeral—The first exclusively automobile funeral ever held in Milwaukee, Wis., was that of Mrs. W. E. Allen, wife of the president of the W. E. Allen Company. The procession was led by the funeral director in an electric coupé, followed by an automobile hearse and the cars of Mr. Allen's customers.

Automobile Incorporations

AUTOMOBILES AND PARTS

AUBURN, IND.—De Soto Motor Car Company; capital, $20,000; to manufacture automobiles and parts. Incorporators: L. M. Field, Hayes Fry, Glenn Fry, V. Van Sickle, H. H. Clark.

BARKER, N. Y.—Progressive Motor Car Company; capital, $30,000; to manufacture automobiles. Arthur H. Tersteeson, John B. Smith, Harry C. Schuhr.

CHICAGO, ILL.—Keeton Motor Company; capital, $60,000; to manufacture automobiles. Incorporators: L. C. Roberts, K. R. Roberts, W. C. Spenny.

DETROIT, MICH.—Tyro Manufacturing Company; capital, $5,000; to manufacture and deal in automobiles. Incorporators: Roy I. Wellington, William C. Stuart, F. J. B. Gerald.

DOVER, DEL.—American Motor Fire Apparatus Company; capital, $1,000,000; to manufacture all kinds of machinery and automobile trucks with appliances for fighting fires. Incorporators: P. F. B. Bithell, P. S. Chambers, Thomas L. Pfarr.

ELGIN, ILL.—Elgin Motor Company; capital, $20,000; to manufacture automobiles. Incorporators: Edward J. O'Beirne, E. J. Adamek, Charles D. Adamek.

FOND DU LAC, WIS.—R. C. Wells Manufacturing Company; capital, $200,000; to manufacture automobiles and accessories.

FT. WAYNE, IND.—Auburn Auto Company; capital, $15,000; to manufacture automobiles. Incorporators: Fred Eckhart, Adolph Schultz, Alfred M. Horstman, Lewis Watson.

GUELPH, CAN.—C. Kloepfer, Ltd.; capital $250,000; to manufacture automobiles.

NEWCASTLE, IND.—Rose City Auto Company; capital, $10,000; to manufacture automobiles. Incorporators: Frank E. Smith, Charles W. Mouch, William F. Byrket, Howard M. Van Matre, Gordon Cameron, Lawrence W. Bailey, Albert D. Ogborn.

NEWARK, N. J.—American Radiator Works; capital, $25,000; to manufacture automobile radiators. Incorporators: Max Steiner, Simon Goldstein, Abraham Marcus.

NEW HAVEN, CONN.—Stutz Motor Car Company; capital, $10,000; to deal in automobiles. Incorporators: P. H. Chandler, Edward J. Barlett.

NEW YORK CITY, N. Y.—Auto Exchange & Equipment Company; capital, $1,000; to deal in automobiles. Incorporators: Harry Lauterbach, Idella Lauterbach, Charles A. Spencer.

NEW YORK CITY, N. Y.—Joseph H. Penders, Inc.; capital, $25,000; to deal in automobiles and taxicabs. Incorporators: John H. Penders, Elizabeth Penders, Catherine Hahr.

PHILADELPHIA, PA.—Fortman Manufacturing Company; capital, $100,000; to manufacture and deal in automobiles.

RICHMOND, VA.—Colonial Beach Motor Company; capital, $5,000; to manufacture automobiles. Incorporators: F. W. Alexander, George Staples, H. W. B. Williams.

ROTTERDAM, N. Y.—General Vehicle Company; capital, $10,000,000; to manufacture automobiles. Incorporators: A. E. Jackson, S. L. Whitestone, J. F. Zoller.

SOUTH BEND, IND.—South Bend Motor Car Works; capital, $10,000; to manufacture automobiles. Incorporators: John D. J. Farneman, Alfred C. Mechlenburg, Hilton Hammond.

ST. LOUIS, MO.—Auto Products Company of America; capital, $25,000; to manufacture automobile parts and accessories. Incorporators: Warren W. Smoot, A. E. Smoot, Eugene B. Stinde.

WABASH, IND.—Sterling Absorber Company; capital, $10,000; to manufacture vehicle springs. Incorporators: M. Tillman, C. Huff, J. Kaiser.

Dr. J. A. Holmes, director of the Bureau of Mines, visited Panama in November for the purpose of investigating the fuel supply on the canal.

Quincy Buys Kissel—The Kissel Motor Car Company of Hartford, Wis., has made delivery of a combination hose and chemical car to the city of Quincy, Mass.

Johnson Manager—Charles R. Johnson has been appointed manager of the Kopmeier Motor Car Company, Milwaukee, Wis. Mr. Johnson succeeds John McDonald, who resigned on November 15.

The Company Moves—The Northwestern Shawmut Tire Company has moved to 1210 Hennepin avenue, Minneapolis, Minn. The company has taken the agency also for Warner instruments. A. J. Hunziker is manager.

Equipment Company Sold—The Motor Equipment Company of Seattle, Wash., owned and managed by Edward J. Strelau, has been sold to Ballou & Wright of Portland. The new firm will take possession December 1.

Good Roads Compaign—A campaign against narrow-tired wagons, particularly those designed to carry heavy loads, has been commenced by the good roads committee of the Milwaukee, Wis., Automobile Club, with special reference to Milwaukee county roads.

Louisiana's Road Improvement—Road improvement during 10 months of 1912 in Louisiana cost $2,310,976.81 according to a report just issued by the State Highway Department. Over 500 miles of road was built or repaired. The average cost of new roads was $6,000 per mile.

Franklin's Annual Conference—At the annual conference of the district sales managers of the Franklin Automobile Company held in Syracuse, N. Y., during the past week reports coming from all parts of the country indicate that the 1913 season will be larger in point of sales than any other in the history of the company.

Automobile Incorporations

GARAGES AND ACCESSORIES

APPLETON, WIS.—Lion Liner Company; capital, $5,000; to manufacture and market a patented inner liner for pneumatic tires. Incorporators: Anton Scheurle, Edward Greve and Fred C. Goodman.

BELOIT, WIS.—Beloit Automobile & Machinery Company; capital, $10,000; to conduct a garage. Incorporators: C. F. Brewer, Jerome Davis, R. J. Davis.

BROOKLINE, MASS.—Coolidge Corner Garage Company; capital, $5,000; to repair automobiles. Incorporators: S. A. Davis, F. O. White, Cyrus Brewer.

CHICAGO, ILL.—Hanway Starter Company; capital, $75,000; to manufacture automobile accessories. Incorporators: J. D. Rourke, R. C. Nicholson, I. Goldstein.

DAYTON, O.—McVey Manufacturing Company; capital, $60,000 to manufacture automobile accessories. Incorporators: J. L. McVey, Walter C. Fraine, A. N. Burkhart, R. J. McCarty.

NEW BRUNSWICK, N. J.—Middlesex County Garage & Sales Company; capital, $100,000; to conduct a general automobile business. Incorporators: H. A. Boyd, J. Mershon, C. A. Oliver.

NEW YORK CITY, N. Y.—Gross Auto Rental Company; capital, $5,000; to rent automobiles. Incorporators: Jacob S. Gross, Simon Gross, Herman Strizver.

NEW YORK CITY, N. Y.—Auto Record Publishing Company; capital, $10,000; to publish automobile trade papers, etc. Incorporators: Chas. A. Loring, John W. Buckmaster, I. E. Buckmaster.

NEW YORK CITY, N. Y.—Twelfth Street Garage Company; capital, $60,000; to conduct a general garage business. Incorporators: Wm. J. Devlin, Jr.; Douglas G. McCotter, Geo. M. Hamilton.

TORONTO, CAN.—Bulldog Tire Company; capital, $300,000 to manufacture tires. Incorporators: Wm. J. Tubman, Jennie H. A. Blair, Irene Rouse.

WHITE PLAINS, N. Y.—General Rim Company; capital, $150,000; to supply motor vehicles and accessories. Incorporators: William Kaul, Robert W. Ashley, Frank Oberkirsch.

WILMINGTON, DEL.—Torkington Tire Company; capital, $1,300,000; to acquire and take over the business of the Torkington Solid Automobile Tire Company. Incorporators: Isaac Fogg, Geo. D. Hopkins, Geo. W. Dillman.

WILMINGTON, DEL.—Zee-Zee Tire & Rubber Company; capital, $1,000,000; to manufacture and deal in tires.

CHANGES OF CAPITAL AND NAME

CHICAGO, ILL.—Langer Auto Castings & Foundry Company; name changed to Diversey Foundry Company.

CLEVELAND, O.—Peerless Motor Car Company; increase of capital from $3,000,000 to $10,000,000.

DETROIT, MICH.—Chalmers Motor Company; increase of capital from $3,000,000 to $5,000,000.

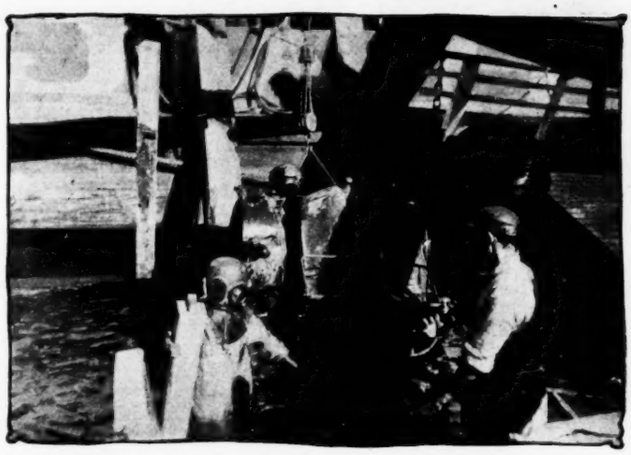
DETROIT, MICH.—Continental Motor Manufacturing Company; increase of capital from $500,000 to $2,400,000.

DETROIT, MICH.—Hupp Motor Car Company; increase of capital from $500,000 to $750,000.

DETROIT, MICH.—Moyer Shaw Manufacturing Company; increase of capital from $50,000 to $500,000.

LOUISVILLE, KY.—Wieland Company; name changed to Louisville Auto & Wagon Company; capital increased from $6,000 to $10,000.

RICHMOND, IND.—Westcott Motor Car Company; increase of capital from $250,000 to $350,000.



Divers raising the Hupmobile of H. L. Watrous from the steam packet Josie which went to the bottom of Lake Ponchartrain, La., recently. Mr. Watrous took part in the Glidden tour

Convicts on Roads—Permission has been granted for the continuation of the policy of using convicts on road work in Louisiana. All convicts that can be spared from the penal farms will be used on the road during 1913 as they have been this year. It is hoped to improve at least 100 miles of highway with the convict gangs alone.

Sergeant Y. M. C. A. Instructor—Hugh M. Sergeant, chief draughtsman of the Racine Manufacturing Company of Racine, Wis., has been selected as instructor of automobile construction in the new motor school of the Racine Y. M. C. A. Mr. Sergeant is a graduate of the N. Y. Technical Institute and author of Practical Problems for Vehicle Machinists.

Builds $15,000 Garage—The Jenkins Automobile Company, owned and managed by Judge F. M. Jenkins, Chippewa Falls, Wis., is having plans prepared for a large garage building, which will be the home of the Mitchell, Paige and Regal. The building will cost in the neighborhood of $15,000 and will contain a commodious and well-equipped repair department.

New Indiana Automobile Laws—Senator J. J. Netterville, of Anderson, Ind., has prepared a bill providing an annual license fee for automobiles, new speed regulations, and that the money collected from the licenses shall be distributed among the different counties for road building and repair purposes. It is estimated the licenses scheme would net from $250,000 to $300,000 a year.

Automobile Nuisances Past—The days of the loud horn or whistle, the open muffler, the smoking automobile are numbered as far as South Bend, Ind., is concerned. At a meeting of the Council committee an ordinance was approved to govern these matters, and as the committee is composed of the entire Council the ordinance will become a law at the next regular meeting of the Council.

Boat Company's Garage—The Portage Boat & Engine Company, Portage, Wis., manufacturing manual and power boats and motors, intends to build a large garage at Portage beginning this winter. The building will have ground dimensions of 40 feet by 132 feet, one story and basement of fireproof construction. At present the motor car selling, repair and storage business is conducted at the boat factory.

Fire Apparatus a Success—The automobile fire apparatus used in Baltimore, Md., has proved such a success that the Fire Board has decided to ask the Board of Estimates to allow an appropriation for converting at least four engines into automobile steamers. It is also planned to replace the horse-drawn vehicles used by the district chiefs with automobile wagons similar to those used by the chief and deputy chief.

Stoughton Garage Completed—Thomas Oscar and M. O. Flom, owners of the firm of Oscar & Flom, Stoughton, Wis., have completed their new garage building on North Water street, but it will not be completely ready until March 1. The garage will contain a large repair shop, offices and storage rooms, and a 3-ton elevator will be installed. The building is 46 feet by 90 feet, two stories and basement, with a one-story addition, 26 feet by 35 feet.

K-W Lighting Generator

Low-Tension, Three-Magnet Apparatus Produces Enough Current for Two 15-Watt, 16-Candlepower Lamps

New Device Has No Brushes and Wound Armature—Is Driven from Flywheel or Fanshaft

THE K-W Ignition Company, Cleveland, has brought out a low-tension, three-magnet machine, Model LS, Fig. 1, which has sufficient capacity to light two 6-volt, 2.5-ampere, 16-candlepower lamps when driven at speeds of from 900 to 3,000 revolutions per minute.

The constructional features of the latest instrument are identical with K-W practice. Like its K-W low-tension generator the new machine in standard form is intended to be driven by a friction wheel which bears on the flywheel face. However, if the latter is inclosed, the magneto may be driven from the fan shaft by a pulley. There are three optional sizes of friction wheels, with 3, 4 and 5-inch diameters, respectively. Any size of pulley from 1.5 to 6 inches is furnished to suit specific conditions.

The new magneto stands 9.5 inches high, has an overall length of 7.5 inches and a width of 4.5 inches. The weight is 18 pounds. When used for ignition purposes, this magneto must be operated in connection with a spark coil which is supplied at an additional cost. The instrument is not intended for use in connection with any type of battery whatever, and further, it cannot be used for battery charging, since the current which it furnishes is alternating. The latter current is not adapted for storage battery charging.

Fig. 1 shows the mounting of the magneto in a special bracket on its side. This bracket is fitted with springs on which the front end of the magneto rests. The function of these springs is to hold the friction wheel in contact with the flywheel face.

The peculiar internal construction of the K-W magneto or generator is shown in Fig. 2, which is a view with the lower part of the base removed. The rotor, seen more clearly in Fig. 3, is mounted in two ball bearings C, Fig. 2, one at either side of the side pieces.

In the K-W patented construction, there are no brushes, or other sliding contacts and no wire-wound armature. Instead of the latter there is a stationary, flat spiral winding, Fig. 4, which is fixed as at A, Fig. 2. On the rotor shaft, there are two inductors or segments B, the axes of which are at right angles. These revolve between the poles or ends of the magnets, and in the brass case, which is practically waterproof when the lower portion is in place.

In revolving, the ends of these inductors B cut the lines of force passing from one set of poles of the permanent magnets to the other set, thereby inducing a magnetic flux in the stationary winding, the direction of which is reversed four times per revolution of the rotor, that is, every time the lines are cut by an end of one of the segments B. The current is conveyed to the binding posts at the end of the magneto through the terminals of the winding which extend up through the top of the rotor case, connecting with these binding posts.

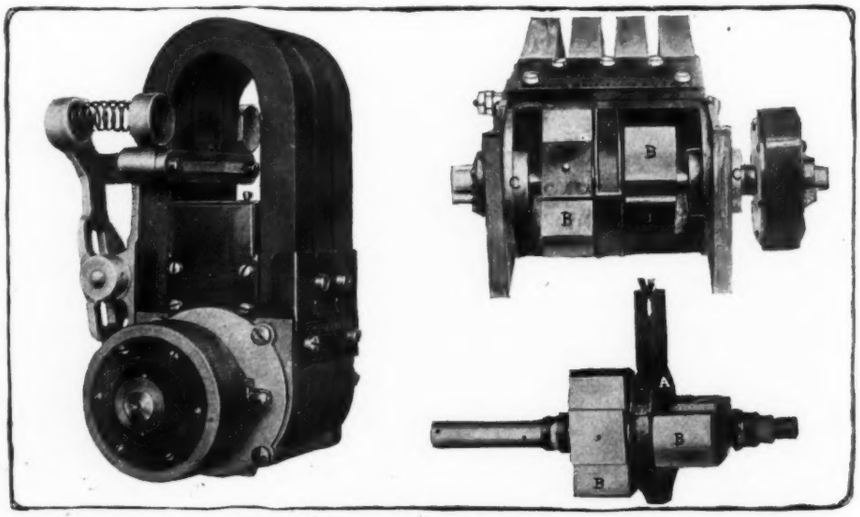


Fig. 1—K-W magneto. Fig. 2—Interior of device. Fig. 3—Details of K-W rotor

New Maxi Carbureter

Low-Speed and Intermediate-Speed Jets Are Aided, at High Speeds, by Nozzles Bored in Arc-Shaped Member

After the Carbureter Has Once Been Fitted, No Adjustments by the User Are Required

A MULTIPLE-JET carbureter which does not require to be adjusted after having once been installed on a car and suited to its specific requirements, is made by the Maxi Company, 37 Wall street, New York City. The construction of the device is clearly seen from Fig. 4. Gasoline is admitted at A2, passes through a screen S and the passage P controlled by the needle N into the float-chamber which contains the copper float F. The operating principle of the float is conventional and requires no explanation; the priming device which is shown at P1 is equipped with two springs, the only ones used in the apparatus. The gasoline leaves the float-chamber by way of the exit passage E, after passing through a second screen S1.

Fig. 4 shows the carbureter with the throttle in the closed position used when starting. In this case, the gasoline flows from the float-chamber through F1, G2 and G into the low-speed nozzle G1 which protrudes through the throttle T, being surrounded by an air hole H. The latter, in practice, is so proportioned that the throttle when turned in the direction of the arrow clears G1. At low speeds, air is supplied principally through A, although a little enters through the open mouth A1 of the throttle tube. When the throttle is opened slightly, gasoline flowing up through G3 is sprayed at the mouth of G4, and when the throttle is opened still further, fuel rises through the pipes R, fills the horizontal pipe H and is atomized at the ends of the bores formed in the arc-piece A3 which communicate with H. These bores or high-speed nozzles come into action, as the throttle uncovers them on its downward rotation. The capacity of G4 is determined by the passage formed in the plug G3; likewise, G2 and G determine the capacity of G1, thus permitting the adaptation of the carbureter to the requirements of the motor. The low-speed gasoline nozzle is bored with a No. 55 drill, air hole H with No. 60, the passage P and that above G3 with No. 55, in the case of a 1-5-inch carbureter. This carbureter is 5.5 inches wide, 6 inches high and weighs 5 pounds. The carbureter is made in four sizes, 1, 1.25, 1.5 and 1.75 inches.

Merralls Compressed-Air Starter A Rotary Engine

Device Is Shaped Similarly to Centrifugal Pump, But Contains Six Pistons Working in Individual Cylinders Secured to Casing—Ingenious Operating Mechanism Controls Valves and Connects Starter with Crankshaft

The Air Needed for Starting Is Stored in a Tank Which Is Supplied Either by An Air Compressor Driven by the Engine, or by an Explosion Air Valve Operated by the Impulses in the Engine Cylinders

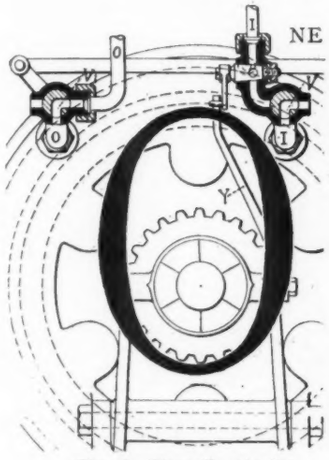
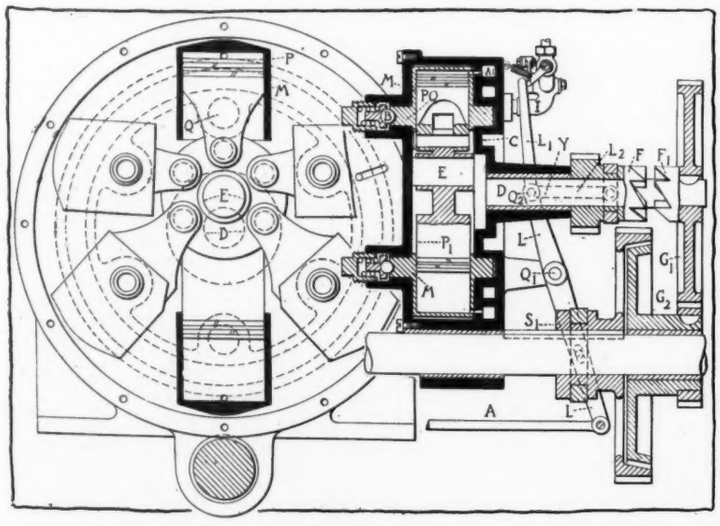


Fig. 1—Merralls starter

ONE more self-starter has been announced this week, which is of the rotary engine type and operated by compressed air, generated either by an air compressor or an explosive air valve, actuated in each case by the engine and storing the air in a tank. The Merralls starter consists of five small compressed-air motors of the reciprocating type which are inclosed in a circular casing and the connecting-rods of which actuate an eccentric mounted on the driving shaft of the starter.

The details of construction of the Merralls starter are shown in Figs. 1, 2 and 3. Fig. 2 is a view of the interior of the device, as seen after the front cover has been removed. Five small motor cylinders M are pivoted at Q to the casing, the pivots containing the ball bearings. The small working pistons P which are fitted into the cylinders M bear upon the eccentric E of the driving shaft D, which eccentric is formed integrally with piston P1 working at the bottom portion of the casing. As Fig. 3 shows, the inlet pipe I provides an admission passage for the air actuating the cylinders, which enters at the point where I connects with the casing C and passes through a bore in the same into spaces A1 opening into the interior of the six cylinders M. The bore being located at the outer ends of the cylinders, the compressed air forces the pistons in the cylinder toward the axis of shaft D around which the eccentric is revoluble. The pistons are so set upon the eccentric attached to E, Fig. 2, that each piston receives its impulse when positioned tangentially, relative to E. The impelling air exhausts through bores in the cylinders nearer to the center than the inlet bores, and thence it streams to the outlet pipe O, Fig. 1. Fig. 3 also illustrates the mechanism by means of which the admission of air to the starter is regulated and which incidentally throws the starter in and out of gear with the gear secured on the crankshaft for starting the motor. An arm A is connected to a handle or pedal in reach of the driver and is linked to a lever L fulcrumed at Q1 and pivoted at Q2 to levers L1 and L2. L1 is connected to a small lever which governs the inlet valve V, Fig. 1, which is operatively connected with the outlet valve V1, so that both are opened and closed simultaneously. Thus when A is pulled toward the left, referring to Fig. 3, air passes through the starter and the shaft D is rotated including the slidable dog F keyed to it. As the movement of A which admits air to the apparatus also moves the dog F away from the casing, F is brought into engagement with the dog F1 formed integrally with a driving gear G1 meshing with a driven gear G2 on the crankshaft; due to this engagement the gear is driven in counterclockwise, looking from C toward G1. As the engine is started and travels faster than the starter, F1 becomes the driving dog, and F, which carries no load, an idler which travels faster than F1 and is thereby thrown out of mesh. This moves Q2 toward the starter casing and shuts off the air valves. The starter may be made to suit various car designs, and fitted to the cars so as to drive a gear on the crankshaft or the flywheel. It is the invention of W. A. Merralls, New York City.



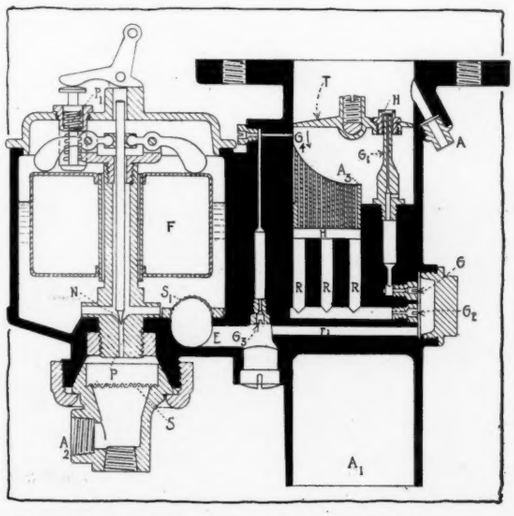


Fig. 2—Interior of the Merralls starter. Fig. 3—Longitudinal section through Merralls starter. Fig. 4—Maxi carbureter

Cahill Special Shock Absorber Designed for Ford Cars; Diamond Tire Sleeve and Repair Patch; Ionides Automobile Information Calculator; Emil Grossman Gradient Meter; Allen Radiator Cover for Winter Traveling

Cahill Shock Absorber for Fords

A CONSIDERABLE number of accessories announced during the past few months have been constructed especially to increase the comfort of drivers and owners of Ford cars, and the latest addition to the list of these devices is the shock absorber, or rather compensating shackle, Fig. 1, which is made by the Cahill Auto Works, Incorporated, 1700 Broadway, New York City. This device is constructed to take the place of the rear-spring shackle on a Ford car, each set of Cahill shock absorbers comprising two shackles which are dimensioned to fit in place of the standard, ordinary shackles. The latter are, as is well known, of the common shackle design, shaped a good deal like the links of a driving chain, and have one cross pin secured to the spring support and another to the longest lead of the cross spring. The Cahill shackle, on the other hand, consists of two pins, a pair of stems, a spring coiled around each stem and a cross-head connecting the upper ends of both stems. The two pins are secured to the spring support and spring end in the same way as the pins of the ordinary shackle, and the connection between them consists of the stems, which are fastened to the spring-end pin, and the coiled springs surrounding the stems and pressing against the top cross-head, which are secured to the pin carried by the spring support

Allen Winter Radiator Cover

With the approaching of the cold season the Allen Auto Specialty Company, 1926 Broadway, New York City, known as makers of tire covers and tire gauges, has added another accessory to its line. This new product is the Allen radiator cover shown in Figs. 6 and 7. Its front side is made of imitation leather while the inside which bears against the radiator front, is of robe plush, distinguished as a poor conductor of heat. The leather is cut to a size fitting a certain class of cars, ranging from 25 to 60 horsepower. The central portion of the cover is attached to the main body by a seam along its lower edge, so that the lowest portion of the radiator surface is always protected when the cover is in place. The central portion may be bent down along this seam and secured in place by any one of the three pairs of snap fasteners which are provided on the main body of the cover. Thereby, only the top or a greater portion of the radiator may be exposed to the wind created by the moving car, or the whole front surface may be covered if the weather is very cold. The lowest portion of the radiator, however, is always protected when the cover is in place. A strip attached to the top portion covers the uppermost part of the central part when the latter is fully covering the surface, preventing snow or rain from getting on the radiator. A flap formed on both sides of the cover and one on top adhere to the longitudinal surfaces of the radiator, and the top flap is cut in the center so as to fit around the radiator filler cap, while the bottom section of the cover attaches to the car by straps which may be drawn through the two eyelets provided in that part of the accessory. The straps are, of course, fastened to the car in the most suitable way, depending upon the make and design of the car. The appearance of the product is distinguished, while the materials used inspire confidence in its efficacy.

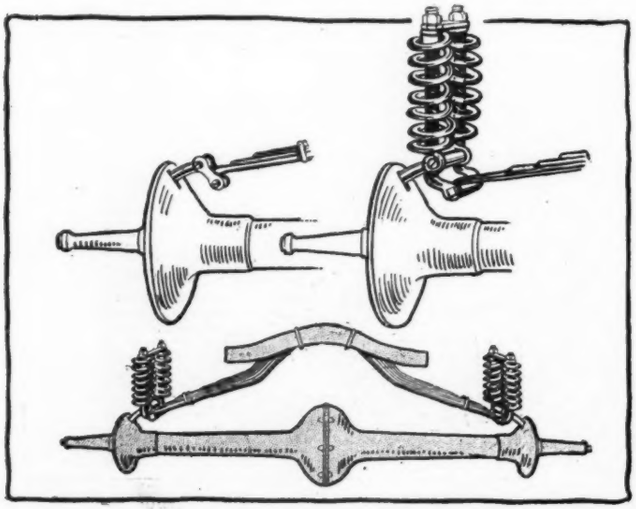


Fig. 1—Cahill shock absorber shackle for Ford cars

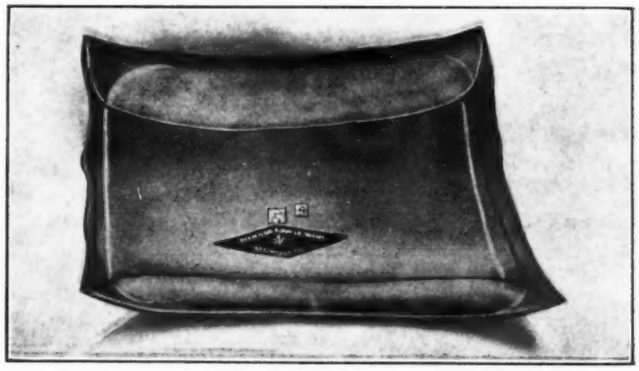


Fig. 2—Diamond tire inside blowout patch

Emil Grossman Gradient Meter

The Emil Grossman Company, 250 West Fifty-fourth street, New York City, has begun to manufacture a simple gradient indicator, the E. G., Fig. 5. This little device is made of nickel-plated steel and is of the shape shown in the illustration. To indicate the grade of the road over which the car travels, a curved glass tube is contained in the metal casing, and this tube is filled with alcohol and contains a metal ball which rolls on the glass track formed by inner surface of the tube. The ball naturally assumes at all times the lowest possible position, and by combining the glass tube with an indicator scale giving the gradient in per cent., the incline may be easily gauged by a simple look at the device. The latter is simply attached to a horizontal surface of the car, such as one of the side boards fitted to the driver's seat, being held in place by screws passing through two holes in the base plate of the casing.

Diamond Tire Patch and Sleeve

The Diamond Rubber Company, Akron, O., has increased its line of tire repair specialties by a blowout patch and a tire repair sleeve, Figs. 2 and 3. The blowout patch is made of several layers of Sea Island cotton frictioned together by Para rubber; the form of the patch is a rectangle differing slightly from a square. The inner portion of the patch is thicker than the peripheral one, which latter consists of only one layer of fabric and is formed with two flaps which are laid around the bead of

the casing, when the patch is put in commission between the same and the inner tube.

Fig. 3 shows the repair sleeve which is furnished together with the inner patch shown with it. The latter goes between the tube and casing to tighten the latter at the place where it is reinforced externally by the sleeve. The patch is of a fine grade of cotton and made thickest in the oblog, central section, the exterior surface is made with a fine, rubber-like finish. The sleeve itself is made of Sea Island duck and of high-grade rubber, in order to give excellent service. It is, of course, desired, to fit Diamond tires, and is thus made in a number of sizes which fit tightly around the relative sizes of tire casing, when the tubes inside the same are fully inflated. To put the sleeve in place, the following process is carried out. The inner tube is deflated and the patch placed between it and the casing at the place where it is desired to strengthen the fabric of the latter. The rim portion of each side of the sleeve is fitted with four steel hooks designed to fit under the bead of the rim, between the same and the rim of the casing; it is an easy matter to put the sleeve in place by positioning the hooks,

Ionides Motor Calculating Device

A handy instrument by means of which automobilists may easily determine the speed of their engines or cars, as well as the ton mileage obtained per gallon of gasoline, is the Ionides motor calculator, Fig. 3. This device is the invention of A. G. Ionides, designer of the English Polyrhoe carbureter and works upon the principal of the circular slide rule; it has a thick cardboard base, 5 by 5 inches, to the center of which are secured six thin cardboard segments, marked with various values corresponding to the dimensions or performances of the car which is the subject of the calculations. The following tabulation gives

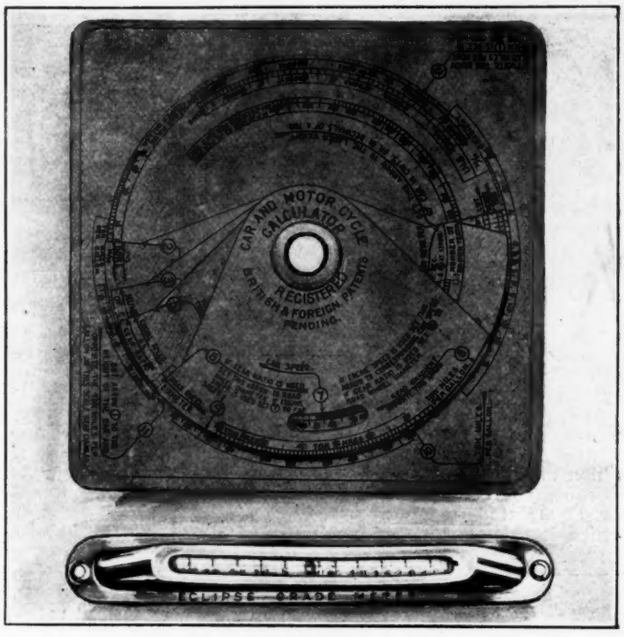


Fig. 4—Ionides motor calculator. Fig. 5—E-G gradometer

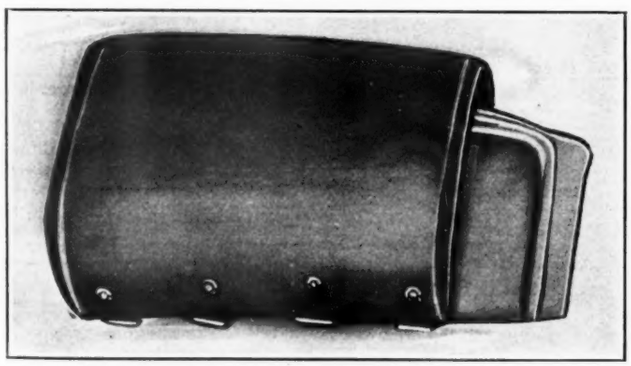


Fig. 3—Diamond clincher casing sleeve and patch

the number of bases provided on the board together with the subjects appearing on its face:

Base	Ton-miles per gallon and miles per hour.
1	Bore, weight, car-miles per gallon and R. A. C. horsepower.
2	Number of cylinders.
3	Stroke of cylinders.
4	Engine speed and number of driven teeth on axle.
5	Number of driving teeth, miles per hour and road wheel diameter.

The segments are independently turnable around the central fastener and by bringing certain points of information to register, others may be read on certain scales. For instance, if one desires to find the ton-miles per gallon the weight of the car is set against an arrow marked for this purpose on the first segment. If the ton-mileage per gallon is known, which may also be calculated by means of this device, the car-miles made per gallon of gasoline may be readily fixed, an arrow in the base cardboard pointing toward a scale marked on the first segment. The Ionides calculator is made by the Motor Calculator Syndicate, Bank Buildings, Kingsway, London, W.

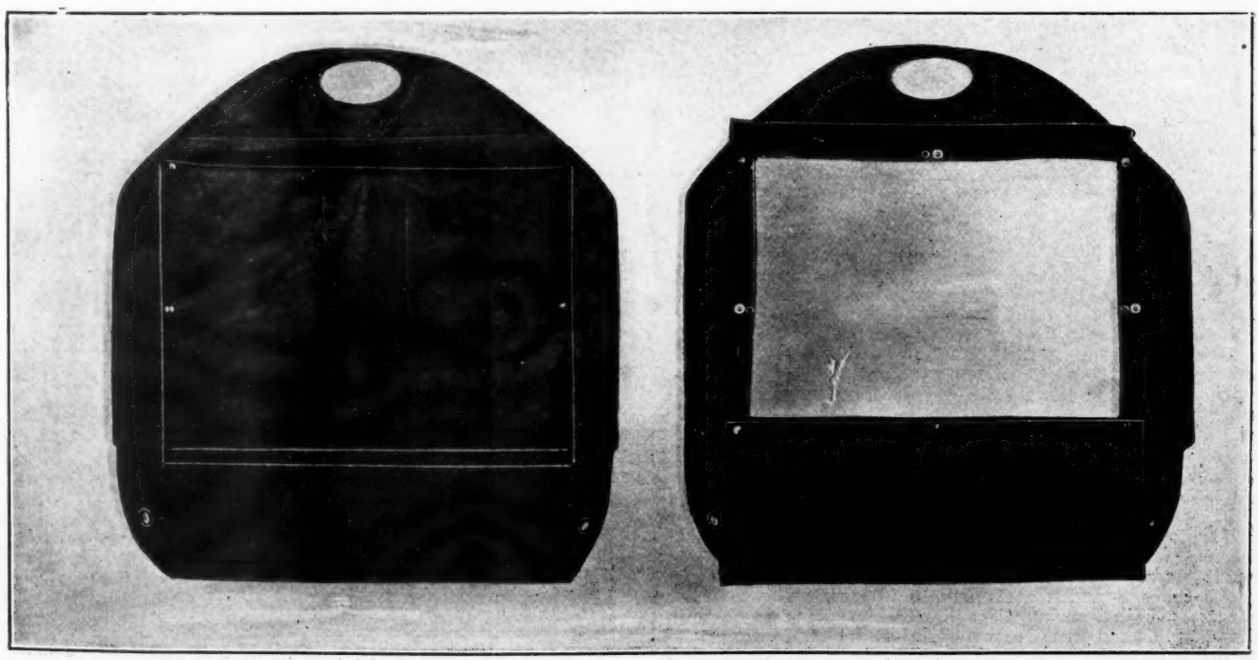


Fig. 6—Allen radiator cover fully closed to protect surface. Fig. 7 —Allen cover two-thirds opened

Patents Gone to Issue

AUTOMOBILE Carbureter—In which a valve operated in conjunction with the throttle regulates the flow of the fuel.

This patent has reference to a carbureter, Fig. 1, in which a mixing chamber C is formed with an air inlet tube A and an outlet passage O; A is fitted to C as a downward, central extension and its communication with C may be interrupted by the valve V which is fitted over the top edge of the inlet tube and is shaped as an obtuse cone. A valve stem fitted centrally to the upper surface of V bears in a bored portion of the carbureter cover, and is surrounded by a spring S which ordinarily presses V against its seat. Fuel is supplied to the carbureter through a jet projecting upwards out of a vessel D fitted to lateral extension of C. Fuel enters at G, which is a short pipe ending immediately above the bottom

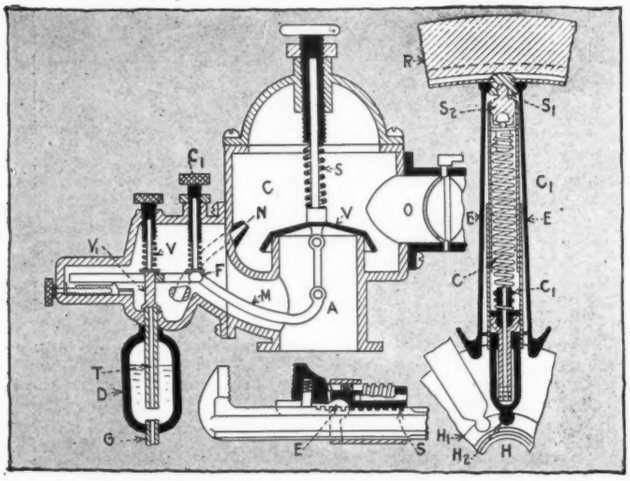


Fig. 1—Watson positive-working carbureter. Fig. 2—Mossberg pipe-wrench design. Fig. 3—Wilkes automobile spring wheel

of D, and fills this vessel to a certain height. A tube T is fitted into D and projects up into the lateral extension of C, the outlet of T being controlled by a valve V1, adjustable on its seat through a knurled screw C1. The valve stem of V1 is connected to the throttle valve V by connecting means M fulcrumed at F, the fulcrum being adjustable from the outside of the casing and having a fork supporting the stem of V1 resting on it.

No. 1,044,314—to Frank C. Watson, Des Moines, Ia. Granted November 12, 1912; filed February 5, 1912.

Pipe-Wrench Construction—In which a frictional contact between the relatively movable parts is used to keep them in fixed relation.

A wrench, Fig. 2, is the subject matter of this patent. It consists of a long rod or shank on which a jaw D is fixed and on which operates a sliding member. The latter is provided with a jaw J pivotally mounted on it, and carrying a pin which is in contact with the rod.

No. 1,044,069—To Frank Mossberg, Attleboro, Mass. Granted November 12, 1912; filed November 2, 1911.

Automobile Spring Wheel—In which sockets fixed to rim and hub carry the spring ends.

The wheel, Fig. 3, has a rim R and a hub H, and telescoping spokes S. Socket pieces S1 with sockets S2 are fitted to the rim, while the hub is equipped with sockets H1 in which heads H2 are pivoted. Both sets of sockets are fixed to the spoke tubes S which are enclosed in elastic sheaths E and contain a coiled spring C each. Every spring is fixed to a detachable head fitted to each rim and hub socket.

No. 1,044,324—to Paul Wilkes, Cleveland, O. Granted November 12, 1912; filed May 20, 1909.

Adjustable Electric Headlight—In which the lamp socket is fixed to the casing and the reflector movable for focusing.

The lamp, Fig. 4, described in this patent comprises a casing C into which a post or socket P for a bulb is fitted. A sleeve movable on P is fitted into the apex of a parabolic reflector R which is in place inside the casing C. The rim of the reflector is formed with a cylindrical flange F which engages slidably a corresponding flange F1 formed on the casing. A screw adjustment S piercing the casing C permits of moving the reflector sleeve on P, thereby altering the focus of the light.

No. 1,044,791—to William F. Anklam, Detroit, Mich. Granted November 12, 1912; filed May 16, 1912.

Rotary-Cylinder Valve—A cylinder slotted with passages registering with the ports in the engine-cylinder heads.

The subject matter of this patent is seen in Fig. 5. A valve, which serves for the inlet and exhaust of a multi-cylinder engine, is composed of split shells S fitted into a cylindrical casing C. The ends of the shells are beveled and engaged by terminally conical members formed so as to prevent axial displacement of the shells. The latter are formed with ports P registering with the cylinder ports. A spring S1 presses the shells securely together.

No. 1,043,816—to Gilbert R. Elliott, Boston, Mass. Granted November 12, 1912; filed August 23, 1911.

Gas Engine Design—In which the fuel supply passage is periodically opened to the atmosphere.

This patent refers to an engine, Fig. 6, which has an inlet valve capable of being opened to the atmosphere and being properly actuated. An exhaust valve is operated by a cam on a shaft which carries another cam, and by means of moving the shaft alternately in a lengthwise direction, both exhaust cams are alternately brought into play.

No. 1,044,289—to John D. Taylor. Granted November 12, 1912; filed April 25, 1910.

Combination Automobile Signal—In which a bulb or an electric motor produces the sound

This patent refers to a signal comprising means for producing sound either by the action of an electric motor striking a diaphragm at intervals, or by a reed and trumpet which latter opens into a projector extending forwardly from the diaphragm mentioned above. The walls of the projector are diverging and open into a bell mouth, whereas the other end of the projector is attached to the diaphragm which affects the sound waves emerging from the open end of the projector.

No. 1,043,704—to Miller Reese Hutchison, New York, N. Y. Granted November 5, 1912; filed May 4, 1910.

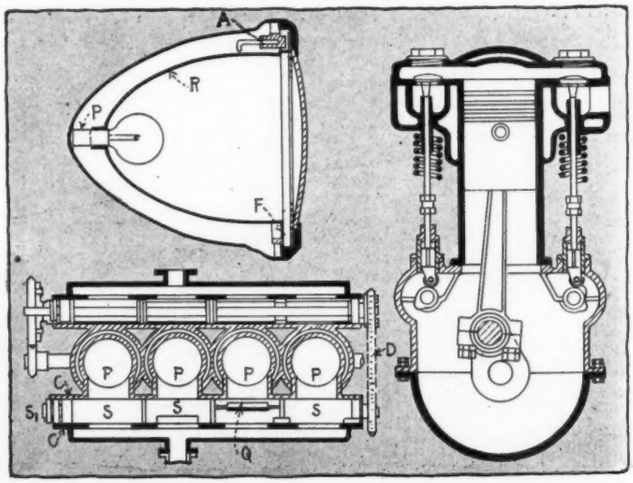


Fig. 4—Anklam adjustable headlight. Fig. 5—Elliott rotary cylinder valve. Fig. 6—Taylor internal-combustion motor